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ABSTRACT

Universities and colleges are a critical component of the nation's research system. The availability and condition of research facilities at these institutions influence the ability of scientists and engineers to conduct research and train the future science and engineering work force. To insure that information regarding these institutions is available, Congress authorized the National Science Foundation to design, establish, and maintain a data collection and analysis capability in the Foundation for the purpose of identifying and assessing the research facilities needs of universities and colleges. This document contains the data collected from 565 institutions. The following questions are addressed in the document: (1) How much space is available for science and education (S&E) research, and how much has this changed over time?; (2) How much more S&E research space is needed?; (3) How good is existing S&E research space, and what improvements are needed?; (4) What is being done to address S&E research facility needs?; (5) Who funds capital projects?; (6) What more remains to be done?; (7) What is the state of S&E research facilities at historically Black colleges and universities?; and (8) What is the state of S&E research facilities at predominantly understate institutions? Four appendices contain technical notes, a list of sampled institutions, the survey questionnaire, and 12 references. (ZWH)

Scientific and Engineering Research Facilities

at Universities and Colleges

1994

Volume I
Analysis

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Highlights . . .

- In 1994, the 565 research-performing universities and colleges in the United States had 127 million net assignable square feet (NASF) of science and engineering (S&E) research space. The top 100 institutions had 82 percent of total academic research and development (R&D) expenditures and accounted for 72 percent of this S&E research space. Other doctorate-granting institutions accounted for 24 percent, and the nondoctorate-granting institutions for 4 percent of S&E research space.

- S&E research space has increased since 1988 at an annual average rate of about 2 percent, from 112 million NASF to 127 million NASF in 1994. Other National Science Foundation (NSF) surveys show that research spending grew by just under 9 percent per year and that graduate enrollment increased by nearly 4 percent per year during this same time period.

- More than 40 percent of all research-performing universities and colleges indicated inadequate amounts of S&E research space in engineering, the physical sciences, the biological sciences outside of medical schools, and the medical sciences in medical schools.

- Twenty-six percent of all S&E research space was judged to be "suitable for use in most scientifically sophisticated research," while 17 percent was rated as needing either major repair/renovation or replacement.

- Overall, projects to construct S&E research space totaled $2,812 million in fiscal years 1992–1993. This amount represented a decline of $290 million in constant dollars (dollars adjusted for inflation) from fiscal years 1990–1991, the first decline in construction spending since NSF began collecting data on S&E research facilities.

- Aggregate spending on repair/renovation of S&E research space declined from $861 million in constant dollars in fiscal years 1990–1991 to $837 million in fiscal years 1992–1993. This overall decline resulted from decreased spending by the top 100 institutions; spending for repair/renovation by other doctorate-granting and nondoctorate-granting institutions increased.

- Public universities and colleges accounted for 70 percent of total fiscal years 1992–1993 spending for S&E research facilities construction and repair/renovation. Almost half (46 percent) of their funds came from state or local sources, another 18 percent from tax exempt bonds, and 14 percent each from the Federal government and institutions' own funds.

- In 1994, the estimated cost of unfunded and deferred capital projects that were included in an institutional plan was $5,744 million. These estimates directly reflected the needs of the 40 percent of universities and colleges that had identified these deferred needs in an approved institutional plan.

- For the panel of 29 Historically Black Colleges and Universities (HBCUs) included since the 1988 survey, expenditures for research space construction declined from $83.2 million (constant dollars) in fiscal years 1986–1987 to $8.6 million in fiscal years 1992–1993.

Scientific and Engineering Research Facilities at Universities and Colleges

1994

Volume I
Analysis

Project Director: Ann T. Lanier

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Foreword to Volume I

Since World War II the Federal government has recognized the key contribution made by academic research to the knowledge base for U.S. technological innovation, as well as to advanced training of the U.S. science and engineering workforce. Over the decades Federal agencies have provided a generous portion of the total support for academic research.

This investment in the nation's scientific and engineering enterprise has paid off over the years by contributing to our competitiveness in global high-technology markets and has improved the health, welfare, and quality of life of our citizens.

It is obvious that state-of-the-art academic research facilities are a necessary element in this successful enterprise. Over the past decades the resources to construct and renovate academic research facilities have been provided by loose partnerships among state, private, and Federal agencies. The relative roles of these sources have fluctuated considerably over time, and there is continuing debate about the appropriate Federal contribution to this function.

Under these circumstances, the need for accurate, reliable, and comprehensive information on academic research facilities is clear. The National Science Foundation was directed to collect the necessary data by the U.S. Congress in section 108 (42 U.S.C. 1886). A pilot study published in 1986 provided the initial materials for a comprehensive report. Subsequent biennial surveys have included modifications and improvements, and Volumes I and II of this year's report contain the results of the fifth survey in the series.

This volume of the report, Volume I, provides a broad quantitative picture of existing research facilities, current construction and renovation efforts, funding sources, plans for future projects, and deferred projects.

This report of survey findings does not address the policy issues at hand. Nevertheless, the data presented here can support a useful policy dialogue among all who strive for a healthy and productive U.S. science and engineering academic research enterprise.

Neal Lane
Director
National Science Foundation

Acknowledgments

The 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges was developed and guided by Ann T. Lanier, Senior Science Resources Analyst, Education and Human Resources Program (EDU), Division of Science Resources Studies (SRS), National Science Foundation (NSF), under the overall direction of Mary J. Golladay, EDU Program Director. Guidance and review were provided by Kenneth M. Brown, Director, SRS, and Cora B. Marrett, Assistant Director for Social, Behavioral, and Economic Sciences (SBE), NSF. Review and comments were provided by Carolyn B. Arena, Project Director for the Academic Instrumentation Survey, SRS, and Nathaniel G. Pitts, Director, Office of Science and Technology Infrastructure, NSF.

The National Institutes of Health (NIH) co-sponsored the project and provided significant financial support as well as guidance and review under the direction of Paul Seder, NIH Office of Science Policy and Technology Transfer.

An Expert Advisory Panel contributed to the survey design, the analysis plan, and the review of this report. Members include the following:

- Dennis W. Barnes, President, Southeastern Universities Research Association
- Richard Blatchly, Professor of Chemistry, Keene State College
- Joanne Cate, Principal Administrative Analyst, Resource Management, University of California System
- Fred Jones, Dean of the School of Graduate Studies and Research, Meharry Medical College
- Robert H. McGhee, Director of Research Facilities Planning, Howard Hughes Medical Institutes
- Julie Norris, Assistant Vice President and Director of Sponsored Programs, University of Houston
- Stanley Stark, Haines Lundberg Waehler, New York, NY

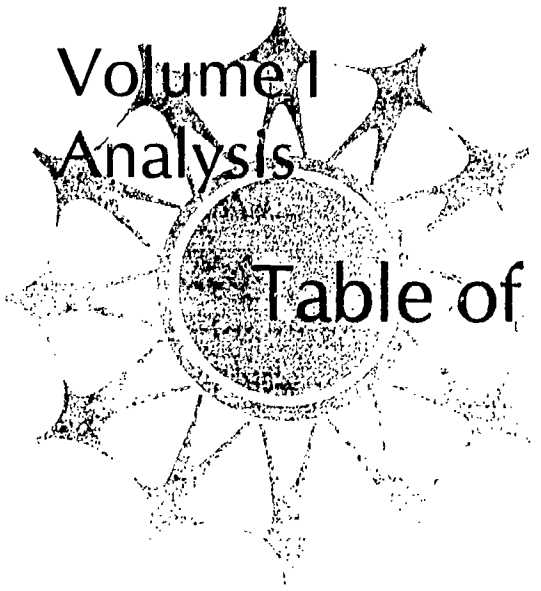
In addition, NSF sought advice on the development of the survey from higher education association and university representatives, who graciously provided information of considerable importance to the success of the project.

Administrators at the higher education associations and societies who reviewed and commented on the report included

- Marvin E. Ebel, Council on Governmental Relations (COGR)
- Howard Gobstein, Association of American Universities (AAU)
- Wayne Leroy, Association of Higher Education Facilities Officers (APPA)
- Jeanne Narum, Independent Colleges Offices (ICO)
- Jerold Roschwalb, National Association of State Universities and Land-Grant Colleges (NASULGC)
- John G. Stevens, Council on Undergraduate Research (CUR)
- William Tibbs, Society for College and University Planning (SCUP)

The 1994 survey was conducted by The Gallup Organization of Rockville, Maryland, under contract to NSF (Contract Number SRS-9317363) Gregory Gaertner served as overall Project Director from Gallup; Jennifer Spielvogel led the field operation; Manas Chattopadhyay was the project statistician; and Renuka Mahalingam directed the data processing for the survey.

Subcontractors for the project were Pelavin Associates and The American Institutes for Research (AIR). Rita Kirshstein headed the Pelavin team, including Jon Cohen who collaborated on the data analysis. Susan Kleimann directed the AIR contributors, including Andrew Rose, Sue Teigen, Renee Ater, and Susan Padrino. Finally, NSF and the project team acknowledge the indispensable contribution of the many officials and staff members at the sample institutions who completed the survey questionnaires.



Volume I Analysis

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Executive Summary

Universities and colleges are a critical component of the nation's research system. The availability and condition of research facilities at these institutions influence the ability of scientists and engineers to conduct research and train the future science and engineering workforce. Numerous Congressional committees have expressed concerns about the quality of these facilities and the costs of maintaining them. Hearings held in both House and Senate committees on science and technology in the mid-1980s led to the conclusion that the condition of these facilities posed a "serious and ongoing problem . . . ." However, insufficient information existed to assess the extent of the problem.

Recognizing the need for information on the amount and quality of scientific and engineering (S&E) research space, Congress mandated that the National Science Foundation (NSF) gather this information and report it to Congress:

> *The National Science Foundation is authorized to design, establish, and maintain a data collection and analysis capability in the Foundation for the purpose of identifying and assessing the research facilities needs of universities and colleges. The needs of universities by major field of science and engineering, for construction and modernization of research laboratories, including fixed equipment and major research equipment, shall be documented. University expenditures for the construction and modernization of research facilities, the sources of funds, and other appropriate data shall be collected and analyzed. The Foundation, in conjunction with other appropriate Federal agencies, shall report the results to the Congress. The first report shall be submitted to the Congress by September 1, 1986* (42 U.S.C. 1886).

Since 1986, NSF has collected data on a biennial basis to address these concerns of Congress. The first study, a "quick response" survey, provided limited data regarding S&E facilities issues. In 1988, 1990, 1992, and 1994, full-scale surveys have provided considerable information about the nations' academic research facilities.

This report describes the findings from the 1994 survey and places them in historical context by comparing results with those from earlier surveys. Following a brief discussion of the study methods, the remainder of this executive summary addresses several key questions regarding S&E research space in research-performing universities and colleges:

- How much space is available for S&E research, and how has this changed over time?
- How much more space is needed?
- How good is the existing space, and what improvements are needed?
- What is being done to address these needs?
- Where does the money come from?
- What more remains to be done?

The final section of the summary profiles two distinct groups of institutions that play important roles in the training of future scientists and engineers: Historically Black Colleges and Universities (HBCUs) and a select group of academic institutions that are oriented primarily to undergraduate education. These predominantly undergraduate institutions consist of comprehensive universities and liberal arts colleges.

What Methods Did This Study Use?

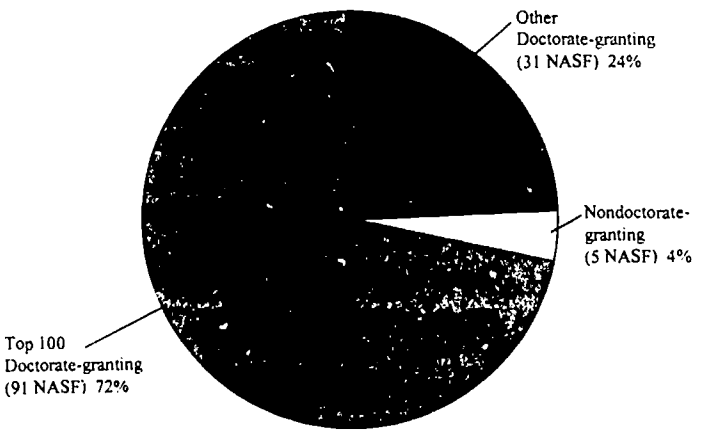
The 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges collected data from a universe of 565 institutions, which included all those with research and development (R&D) expenditures of $50,000 or more and HBCUs with any R&D expenditures.

The 1994 survey was mailed to all sampled institutions in the fall of 1993. Extensive telephone follow-up was used to elicit a 93 percent response rate and to resolve questions regarding incomplete or inconsistent responses. Sampled institutions that had participated in the 1992 survey were also sent a computer-generated "facsimile" of their previous responses. (See Appendix A, *Technical Notes*, for a detailed description of the sampling procedures and data collection methods.)

How Much Space Is Available for S&E Research, and How Has This Changed Over Time?

In 1994, universities and colleges devoted about 282 million net assignable square feet (NASF) of space to S&E fields. Of this space, about 127 million NASF was devoted to research.[1] The top 100 institutions in R&D expenditures housed the most S&E research space, 91 million NASF, comprising about 72 percent of all S&E research space (Figure 1).[2] The top 100 institutions also had 82 percent of total academic R&D expenditures.

Figure 1. Top 100 doctorate-granting institutions have 72 percent of the total 127 million net assignable square feet (NASF) of science and engineering research space: 1994
[NASF in millions]



SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

[1] Throughout this report, research is defined as "all research and development activities of an institution that are budgeted and accounted for." Research can be funded by the Federal government, state governments, foundations, corporations, universities, or other sources. "Research space" refers to the net assignable square footage of space within research facilities (buildings) in which research activities take place. Multipurpose space, such as an office, is prorated to reflect the proportion of use devoted to research activity.

[2] The "top 100" designation is based on institutions' fiscal year 1991 research expenditures, as reported in *Academic Science and Engineering: R&D Expenditures, Fiscal Year 1991*, National Science Foundation, 1993.

Since 1988, the amount of S&E research space has increased steadily, growing at an average rate of about 2 percent per year. From 1988 to 1994, the available S&E research space grew from 112 to 127 million NASF.[3] Most of this increase occurred in the top 100 institutions; engineering experienced the largest growth of any single S&E field.

How Much More S&E Research Space Is Needed?

To answer this question, institutions assessed, for each S&E field, how adequate the amount of existing space was for current research programs. Of those institutions with some research space in each field, at least 40 percent reported inadequate amounts of space in four S&E fields:

- Engineering
- Physical sciences
- Biological sciences outside of medical schools; and
- Medical sciences in medical schools.

The institutions that had the most S&E research space also expressed the greatest need for more space. Over half of the top 100 institutions reported inadequate amounts of research space in all four of the above S&E fields. Fewer than 40 percent of the nondoctorate-granting institutions reported inadequate amounts of space in any field.

How Good Is Existing S&E Research Space, and What Improvements Are Needed?

Of all S&E research space, over a quarter (33 million NASF) was considered suitable for the most sophisticated research, a result driven by the high quality of space at doctorate-granting institutions. Both the top 100 institutions and other doctorate-granting institutions designated about 27 percent of their overall space as "suitable for use in the most highly developed and scientifically sophisticated research . . . ." The nondoctorate-granting institutions classified 16 percent of their space into this category.

[3] The reported figures are conservative estimates of the total amount of space used for S&E research in academic settings. Space used for organized research but also for other purposes is prorated to reflect the proportion of research usage.

The second category of space, space that is "suitable for most uses," included another 33 percent of the total S&E research space. This percentage was fairly consistent across doctorate-granting institutions. Nondoctorate-granting institutions rated 42 percent of their space as belonging to this category.

Twenty-three percent of existing S&E research space was considered to need limited repair/renovation. This percentage was generally consistent across institution types. Thirteen percent of S&E research space was rated as needing major repair/renovation, and another 4 to 5 percent required replacement.

Repair/renovation needs were concentrated in a few S&E fields. The single field requiring the largest proportion of major repair/renovation or replacement was agricultural sciences, in which 22 percent of the existing research space was rated in this category. However, few institutions (20 percent) had agricultural sciences research space. In environmental sciences, about 19 percent of the existing research space needed major repair/renovation or replacement.

Other fields in which 15 percent or more of the total S&E research space needed major repair/renovation or replacement included the biological sciences outside of medical schools (19 percent); the physical sciences (18 percent); the medical sciences, both within and outside medical schools (17 percent for both); engineering (15 percent); and the biological sciences in medical schools (15 percent).

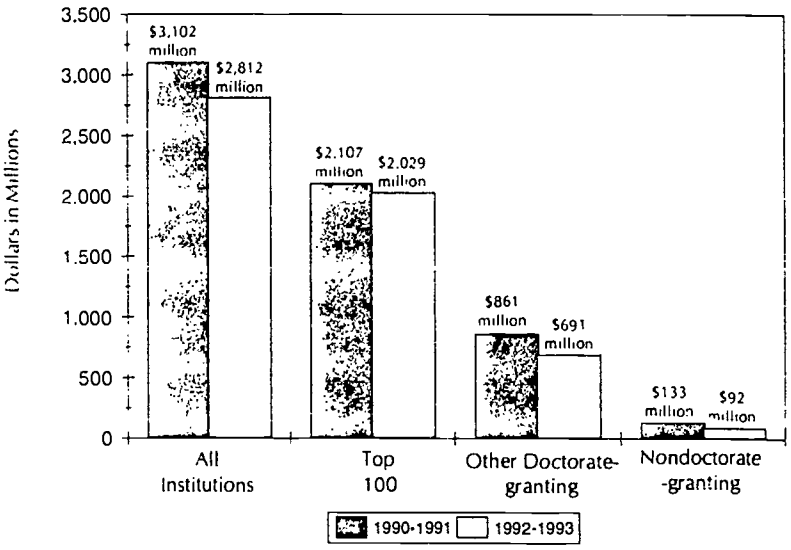
What Is Being Done to Address S&E Research Facility Needs?

In fiscal years 1992–1993, universities and colleges began over $2,812 million of construction for S&E research space. Most of this construction activity, approximately $2,000 million or 72 percent, occurred at the top 100 institutions. Other doctorate-granting institutions spent approximately $691 million on the construction of new S&E research space, and nondoctorate-granting institutions spent $92 million.

For the first time since NSF began collecting data on S&E research facilities, in fiscal years 1992–1993, the inflation-adjusted amount (the constant dollar amount) spent on construction of S&E research space declined.[4] (See Figure 2 on the following page.)

[4] This report used the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction to adjust construction dollar amounts for inflation.

Figure 2. Dollars for construction projects for science and engineering research space declined since fiscal years 1990-1991
[Constant 1993 dollars in millions]



SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Repair/renovation spending for existing S&E research space also declined to $837 million in fiscal years 1992–1993 from $861 million in fiscal years 1990–1991, continuing the decline that began in fiscal years 1988–1989. The decline in repair/renovation was driven by a decline at the top 100 institutions.

Some level of capital projects (either construction or repair/renovation) took place at almost half (46 percent) of all institutions during fiscal years 1992–1993. However, almost all of the top 100 institutions (90 percent) began capital projects, while 25 percent of the nondoctorate-granting institutions did so. Forty-eight percent of the other doctorate-granting institutions began capital projects in fiscal years 1992–1993.

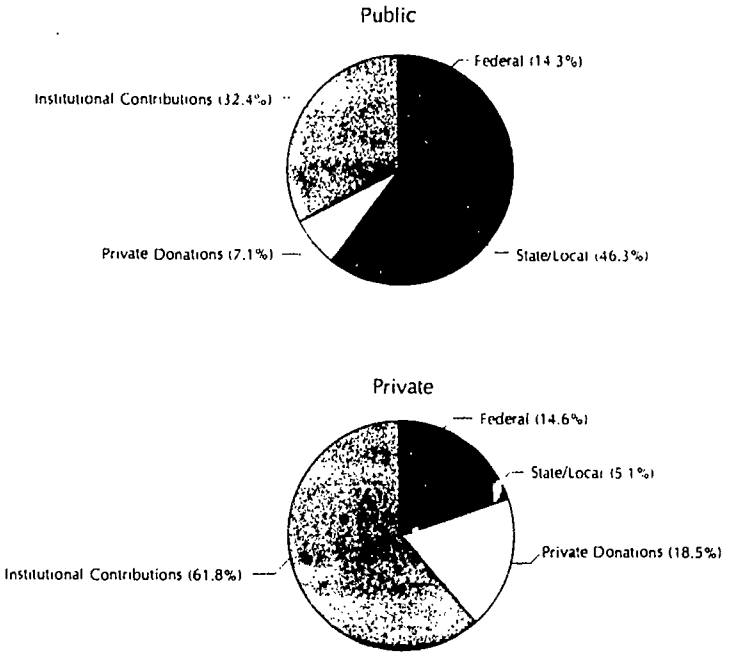
As noted above, agricultural sciences was the S&E field with the largest proportion of space that needed major repair/renovation or replacement. With the exception of S&E fields in medical schools (biological and medical sciences), agricultural sciences was also the field in which the highest percentage of institutions was undertaking construction projects. In fiscal years 1992–1993, 27 percent of all institutions with research space in the agricultural sciences had construction projects underway in that field.

Institutions were more likely to have begun repair/renovation projects than construction projects in most S&E fields. The two exceptions were agricultural sciences and mathematics. In agricultural sciences, 27 percent of all institutions began construction, and 18 percent began repair/renovation projects. In mathematics, 2 percent of all institutions began both construction and repair/renovation projects.

Who Funds Capital Projects?

In fiscal years 1992–1993, public and private institutions drew upon substantially different sources to fund the construction and repair/renovation of S&E research space. Public institutions relied primarily on state and local funding, which accounted for 46 percent of their total funding for capital projects. Private institutions relied primarily on institutional contributions (institutional funds, tax-exempt bonds, and other debt); these funds accounted for 62 percent of the total funding for their capital projects (Figure 3).

Figure 3. Public and private institutions have different funding sources of capital projects for construction and repair renovation of science and engineering research space: 1994



SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

At public institutions, capital funding declined about 4.5 percent between fiscal years 1986–1987 and fiscal years 1992–1993. Private institutions experienced a large drop in capital funding from state and local governments between fiscal years 1990–1991 and the following two fiscal years of 1992–1993. However, the high level of state and local capital funding that private institutions received in fiscal years 1990–1991 was somewhat atypical; it was considerably higher than at any time since fiscal years 1986–1987.

What More Remains to Be Done?

Congress is concerned with determining what universities and colleges need with regard to S&E research space. Determining need is a complex matter, because what is needed must be placed within a framework that is realistic from a budgetary perspective.

In an effort to measure real (as opposed to speculative) needs, the 1994 survey adopted a conservative approach to this issue. (See Appendix A, *Technical Notes*, for a discussion of differences from previous surveys.) It combined institutions' assessments of S&E research space needs with deferred plans to repair/renovate or to construct S&E research space. Institutions reported whether an approved institutional plan existed that included "any deferred space that requires new construction or repair/renovation." Four criteria were used to define deferred space:

- The space must be necessary to meet the critical needs of current faculty or programs;
- Construction must not be scheduled to begin during fiscal years 1994–1995;
- Construction must not currently have funding; and
- The space must not be for developing new programs or expanding the number of faculty.

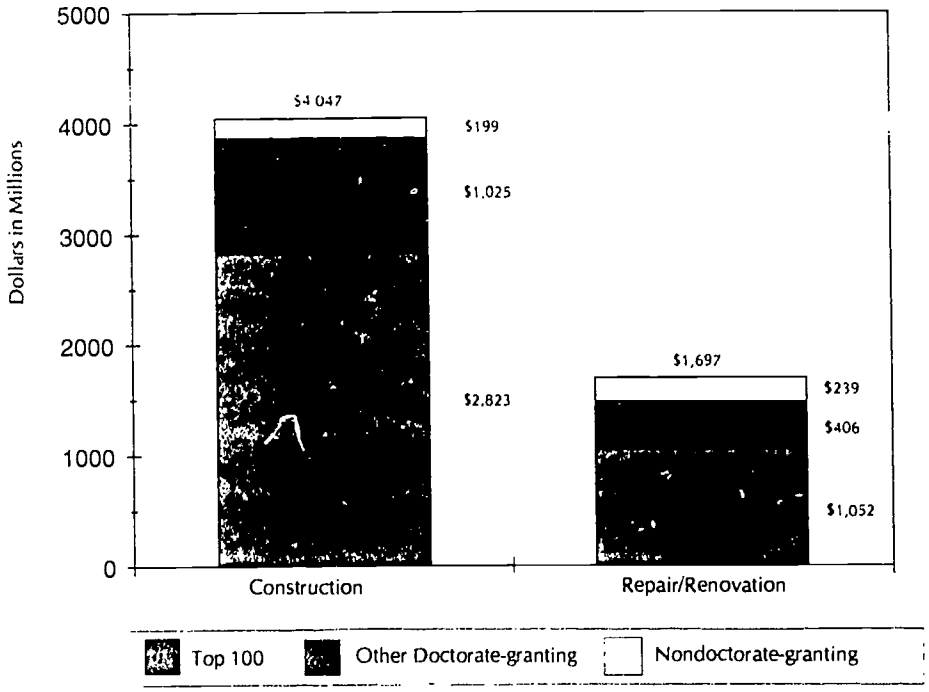
Using these standards, respondents were asked to estimate for each S&E field the construction and repair/renovation costs of such deferred projects.

The strength of this approach is the fact that institutions must make decisions about the distribution of scarce resources to develop and approve these plans. In short, these plans are not wish lists. Therefore, when approved institutional plans include construction or repair/renovation that is deferred (i.e., not planned for fiscal years 1994–1995), it is reasonable to see these deferred projects as needed projects yet to be addressed. Forty percent of responding institutions could report deferred space meeting these criteria; sixty percent did not; the information reported here is based on reports from the forty percent. Although

a less formal definition might well lead to a different estimate than the one reported here, the needs expressed based on these criteria provide a framework for meaningful interpretation of results and the development of trends over future years. These estimates reflect a thoughtful process of deliberation and compromise at the responding institutions.

Deferred capital projects at the 40 percent of institutions with institutional plans amounted to $5,744 million. Of this, $4,047 million reflected needs for construction, and $1,697 million reflected needs for repair/renovation. (Figure 4).

Figure 4. Unfunded science and engineering capital needs total $5,744 million
[Dollars in millions]



SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

The fields in which capital projects were most often deferred included engineering, with 18 percent of responding institutions reporting deferred capital projects; the physical sciences, with 16 percent reporting deferred capital projects; the medical sciences in medical schools, with 16 percent; and the biological sciences outside of medical schools, with 14 percent.

What Is the State of S&E Research Facilities at Historically Black Colleges and Universities?

Historically Black Colleges and Universities (HBCUs) have played an important role in the education of black students at all higher education levels for over 100 years. These universities and colleges consist of both public and private institutions as well as two-year, four-year, and professional schools. In 1991, approximately 269,000 students attended the 105 institutions of higher education considered HBCUs by the U.S. Department of Education. Although the HBCUs have considerably less S&E research space than other research-performing institutions, the HBCUs are an important source of science and engineering degrees for the black students who are currently enrolled in college.[5]

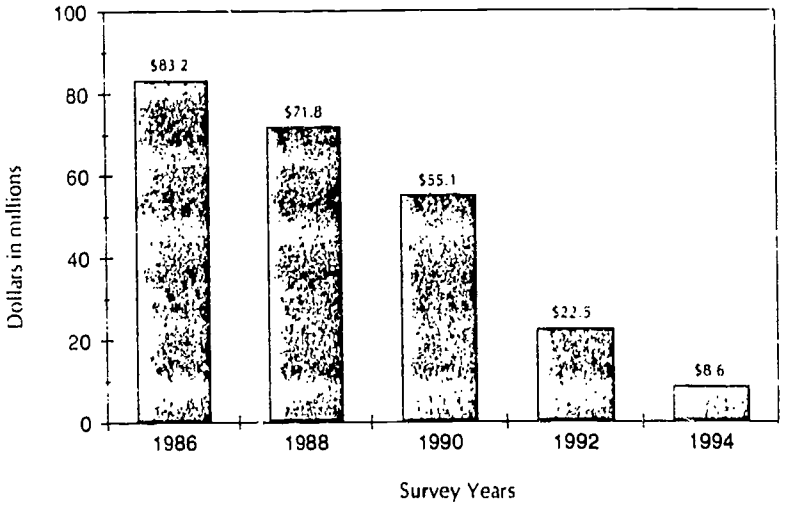
Research-performing HBCUs contained 7.9 million NASF of S&E space, of which 2.2 million were devoted to research. Among a panel of 29 institutions that has been sampled consistently since 1988, the amount of S&E research space dropped slightly, from 1.78 million NASF in 1988 to 1.76 million in 1994.

HBCUs reported that their S&E research space was in fairly good shape. Over 30 percent of space was reported to be suitable for the most sophisticated research, and 9 percent was in need of major repair/renovation.

Construction starts at HBCUs continued a precipitous decline. In fiscal years 1986–1987, the panel of 29 HBCUs spent $83.2 million in constant dollars on construction of S&E research space. By fiscal years 1992–1993, this figure had dropped to $8.6 million, about a tenth of its earlier level. (See Figure 5 on the following page.)

[5] A recent study of science and engineering doctorates revealed that almost 30 percent of black science and engineering doctorate degree recipients between 1985 and 1990 received their bachelors degrees from HBCUs.

Figure 5. Funding for construction at Historically Black Colleges and Universities has declined
(Constant 1993 dollars in millions)



SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

- HBCUs continued to receive most of their funding for S&E research space construction and repair/renovation from the Federal government.

What Is the State of S&E Research Facilities at Predominantly Undergraduate Institutions?

In the National Science Foundation Authorization Act of 1994, the Committee on Science, Space, and Technology expressed concern "that NSF's biennial survey of academic research facilities needs ... has not focused adequately on the needs of undergraduate institutions." The 1994 facilities survey, in the field at the time, was not designed to collect data regarding the specific needs of undergraduate institutions. Furthermore, the sampling frame for this study did not represent all the types of undergraduate institutions of concern to Congress. Nevertheless, the 1994 survey and sample can provide insights into several issues regarding the S&E research facilities of a select group of undergraduate institutions.

Predominantly undergraduate institutions that engaged in separately budgeted S&E research had a total of approximately 25 million NASF of space in S&E disciplines. Analysis divided these institutions into two groups: comprehensive universities (institutions that granted a master's degree as well as a bachelor's degree) and liberal arts colleges. Over 80 percent of the S&E space at predominantly undergraduate institutions was in the comprehensive universities.

Of all S&E space at predominantly undergraduate institutions, only 17 percent was devoted to S&E research, as might be expected because of their educational mission. Almost half of this space was characterized as "effective for most purposes," though not generally suitable for the most advanced research. Approximately 3 percent of the S&E research space was classified as in need of replacement, about the same as all other institutions.

To address S&E research space needs, these institutions invested a total of about $92.3 million in capital projects in fiscal years 1992–1993. Of this total, $65.2 million was spent on construction and $27.1 million was spent on repair/renovation. Of the predominantly undergraduate institutions which had an approved institutional plan that included deferred or unfunded capital projects for S&E research space, deferred capital projects totaled over $356.6 million.

Introduction

Background

Universities and colleges are a critical component of the nation's science and engineering (S&E) research system. The availability and condition of research facilities at these institutions influence the ability of scientists and engineers to conduct research and train future scientists. Numerous Congressional committees have expressed concerns about the quality of these facilities and costs of maintaining them. Hearings held in both House and Senate committees on science and technology in the mid-1980s led to the conclusion that the condition of these facilities posed a "serious and ongoing problem . . . ." However, insufficient information existed to assess the extent of the problem.

Recognizing the need for information on the amount and quality of S&E research space, Congress mandated that the National Science Foundation (NSF) gather this information and report it to Congress:

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Since 1986, NSF has collected data on a biennial basis to address these concerns of Congress. The first study, a "quick response" survey, provided limited data regarding S&E facilities issues. In 1988, 1990, 1992, and 1994, full-scale surveys have provided considerable information about the nation's academic research facilities.

The Survey and its Design

The 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges, like earlier efforts, collected data on the amount of S&E research space in the nation's higher education institutions, the adequacy and condition of this space, the extent to which universities and colleges were constructing facilities and repairing/renovating space, and the funding of this activity. In addition, the 1994 survey gathered for the first time information about unfunded and deferred capital projects for S&E research facilities.

The sample for the 1994 survey was designed to provide efficient and unbiased estimates of the amount of S&E research space in universities and colleges and to retain, as much as possible, comparability with the 1992 sampling procedures. This sample represented a universe of 565 institutions with more than $50,000 in research and development (R&D) as well as Historically Black Colleges and Universities (HBCUs) with any R&D expenditures.

As was the case in previous years, most institutions in the sample were selected with a probability proportional to the square root of their R&D expenditures in thousands. (See Appendix A, *Technical Notes*, for a more complete discussion of sampling procedures.) The final sample of 309 universities and colleges, which represented the universe of 565, included the following:

- All of the top 100 universities and colleges in terms of R&D expenditures (n=100);
- Other public doctorate-granting universities (n=50);
- Other private doctorate-granting universities (n=35);
- Public nondoctorate-granting institutions (n=72); and
- Private nondoctorate-granting institutions (n=52).

The sample of HBCUs was distributed among the 309 universities and colleges. These 309 universities and colleges are described as research-performing institutions throughout the report.

The 1994 survey was mailed to all sampled institutions in the fall of 1993. Extensive telephone follow-up was used to elicit a high response rate and to resolve questions regarding responses. Sampled institutions that had participated in the 1992 survey were also sent a computer-generated "facsimile" of their previous responses. Overall, 93 percent of all universities and colleges sampled completed the survey, an increase from 89 percent in the 1992 survey.

The Report

The 1994 report has been reformatted to help readers obtain answers to a number of key policy concerns. Each chapter contains the following sections:

- *Highlights*, a summary of key findings;
- *Context*, the rationale and background for the data presented in the chapter;
- *The Survey Question(s)*, a description of the question or questions around which the chapter is focused;
- *Data Considerations*, a presentation of data limitations or interpretations; and
- *Findings*, tables, graphs, and text that address questions frequently posed about S&E research facilities.

This report provides information presented in previous reports, particularly data pertaining to trends in the amount, condition, capital activity, and funding of S&E research space, as well as a profile of HBCUs. In addition, the 1994 report includes a chapter on deferred and unfunded construction and repair/renovation projects as well as a profile of institutions that are predominantly undergraduate in orientation. Although information on animal care facilities was presented as a separate chapter in previous reports, this information is incorporated into individual chapters in the current report.

In most chapters, differences among types of institutions and S&E fields are presented. Throughout the report, type of institution refers to the following categories:

- Doctorate-granting, which includes
  - The top 100 institutions in R&D expenditures
  - The other doctorate-granting institutions not in the top 100
- Nondoctorate-granting

Fifteen percent of the HBCU institutions are doctorate-granting; 85 percent are classified as nondoctorate-granting. Throughout this report, HBCUs are included in the data of their appropriate institution type except in Chapter 7, which focuses on predominantly undergraduate institutions. In this chapter, nondoctorate HBCU data are reported separately.

For this survey and report, the S&E fields include the following: engineering; physical sciences; environmental sciences; mathematics; computer sciences; agricultural sciences; biological sciences, both in universities and colleges and in

medical schools; medical sciences, both in universities and colleges and in medical schools; psychology; social sciences; and other sciences, not elsewhere classified.

Chapter 1 presents findings on the amount of research space available in S&E fields at research-performing institutions, currently and over time. Chapter 2 examines the adequacy of the amount of S&E research space as well as its condition as assessed by the institutions. Chapter 3 provides information on the costs in constant and current dollars of constructing facilities and repairing/ renovating S&E research facilities. The sources of funds for these capital projects are presented in Chapter 4.

Chapter 5, new to the 1994 report, examines deferred and unfunded construction and repair/renovation projects. Chapter 6 provides a profile of HBCUs, and Chapter 7, also new to this report, profiles institutions that are predominantly undergraduate in their focus.

Several appendices provide interested readers with more detailed information. Appendix A, *Technical Notes*, presents additional material about the study design and methodology. Appendix B includes a list of sampled institutions. Appendix C contains the survey instrument. Appendix D lists references.

A second volume, *Statistical Tables*, contains detailed statistical information.

Chapter 1

Existing Research Space: Quantity

Highlights . . .

- In 1994, the nation's research-performing academic institutions devoted a total of 282 million net assignable square feet (NASF) to science and engineering (S&E) fields. This total included space used for instruction as well as space used for research. Of the 282 million NASF, research occupied 127 million NASF.
- As in prior years, the top 100 institutions in research and development (R&D) expenditures had the largest share of S&E research space. Of the 127 million NASF that was devoted to S&E research, the top 100 institutions had 91 million NASF, or 72 percent.
- The amount of S&E research space increased steadily, from 112 million NASF in 1988 to 127 million NASF in 1994. This increase amounts to about 2 percent a year, with most of the growth occurring at the top 100 research institutions.

Context

To understand the research facility needs of universities and colleges, it is necessary to know how much research space scientists and engineers in U.S. universities and colleges currently use. Has the amount of space increased or decreased over time? What are the trends for particular types of institutions? What are the trends for particular fields? Do different S&E fields require different amounts of space? This chapter addresses these issues. The next chapter will address whether the amount of research space is adequate and whether the condition of the space is sufficient for conducting competitive research.

The Survey Questions

This chapter discusses the information reported in Item 1a and Item 1b of the survey. (See Appendix C.)

For each S&E field individually, and for all S&E fields combined, Item 1a collects data in units of NASF on

- *Instructional and Research NASF.* This is total space; it includes space that is used for instruction and space that is used for research, and
- *Research NASF.* This is space that is used for research; it does not include space that is used for instruction.

Item 1a also asks for the total NASF for instruction and research for all non-science fields combined as well as a total for instruction and research NASF for both S&E and non-science fields.

For all S&E fields combined, Item 1b requests the amount of research NASF that is leased.

Data Considerations

"How much space do universities and colleges devote to S&E research?" Although this question may appear to be straightforward, several issues complicate the response.

- *Space may be used for more than one purpose or be shared by more than one field.* Examples include a laboratory that is used for research only part of the time or a building that is shared by two or more fields. For multi-purpose or shared space, the survey asks respondents to prorate the space. For example, if a laboratory is used for research 30 percent of the time, respondents should count 30 percent of the laboratory's NASF as research space. If mathematics and computer sciences both use the same laboratory, the NASF reported for each field should reflect the amount of space prorated by the amount of time that field uses the space.

- *Some fields require more space for research than others.* For example, agricultural research requires considerably more space than mathematics research. Thus, a larger amount of research space in any field does not necessarily translate into sufficient research space for that field.

- *In the 1994 survey, research is defined more broadly than in the 1992 survey.* However, this change in definition does not reflect a change in how institutions actually report S&E research space. The 1994 definition includes all research and development activities that are budgeted and accounted for. In some cases, it can also include departmental research not separately budgeted. In prior years, institutions were asked to exclude departmental research that was not a separate budget item. Conversations with respondents from earlier surveys revealed that some departmental research had been included; thus, the current definition of research reflects what institutions had been reporting all along.

Findings

How Much Space Was Available for S&E Research?

In 1994, the nation's 565 research-performing academic institutions had a total of 511 million NASF of instructional and research space in all academic fields. (See Table 1-1 on the following page.) S&E fields occupied 282 million NASF of this total, and research space within the S&E fields comprised 127 million NASF. Other National Science Foundation (NSF) surveys show that S&E research spending grew by just under 9 percent per year and graduate enrollment increased by nearly 4 percent per year.[1]

[1] National Science Foundation, *Selected Data on Graduate Students and Postdoctorates in Science and Engineering: Fall 1992*, NSF 94-301 (Arlington, VA, 1994) and National Science Foundation, *Academic Science and Engineering: R&D Expenditures, Fiscal Year 1991*, NSF 93-308 (Washington, DC, 1993).

Table 1-1. Amount of science and engineering (S&E) research space by institution type: 1994
[Net assignable square feet in million]

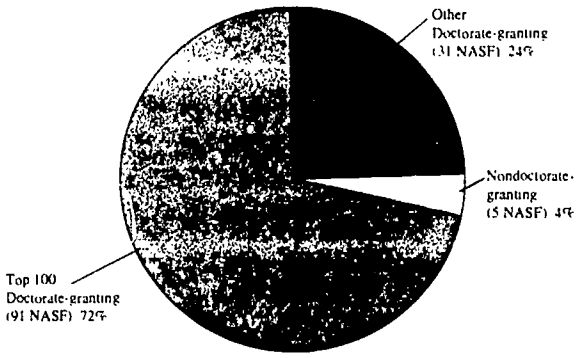
Institution type	Number of institutions	Space in all academic fields[1]	Space in S&E fields	Research space in S&E fields
		Net assignable square feet in millions		
Total	565	511	282	127
Doctorate-granting:				
Top 100 in research expenditures	100	265	171	91
Other	219	163	82	31
Nondoctorate-granting	246	83	29	5

[1] Projected from responses of 83 percent of participating institutions.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

The top 100 institutions contained more space in all academic fields than all other types of institutions. Although the top 100 institutions made up 18 percent of the 565 research-performing universities and colleges, they accounted for 52 percent of the space in all academic fields (265 million NASF). These top 100 institutions had an even greater percentage of the total S&E research space, containing 72 percent of all S&E research space (Figure 1-1). The top 100 institutions had 82 percent of the total academic R&D expenditures in 1991.

Figure 1.1. Top 100 doctorate-granting institutions have 72 percent of the total 127 million net assignable square feet (NASF) of science and engineering research space: 1994
[NASF in millions]



SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

How Was S&E Space Utilized?

In 1994, the total space devoted to S&E fields, including both instruction and research, comprised 55 percent of the total academic space at the nation's research-performing institutions (Table 1-2).

Table 1-2. Science and engineering (S&E) research space utilization: 1994

Institution type	S&E space	Research space	
	As a percentage of total academic space	As a percentage of total S&E space	As a percentage of total academic space
Total	55	45	25
Doctorate-granting:			
Top 100 in research expenditures	65	53	34
Other	50	38	19
Nondoctorate-granting	35	17	6

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

The ratio of S&E space to total academic space varied by the type of institution. The top 100 universities devoted 65 percent of all academic space to S&E. Nondoctorate-granting institutions used 35 percent of their total academic space for S&E fields.

The percentage of S&E space that was used for research also varied. In the top 100 institutions, 53 percent of their S&E space was devoted to research; in other doctorate-granting institutions, 38 percent of the S&E space was devoted to research; and nondoctorate-granting institutions devoted 17 percent of the S&E space to research.

Has the Amount of S&E Research Space Increased?

Since 1988, the amount of S&E research space has increased steadily, from 112 million NASF in 1988 to 127 million in 1994. (See Table 1-3 on the following page.) These numbers represent a total increase of approximately 13 percent.

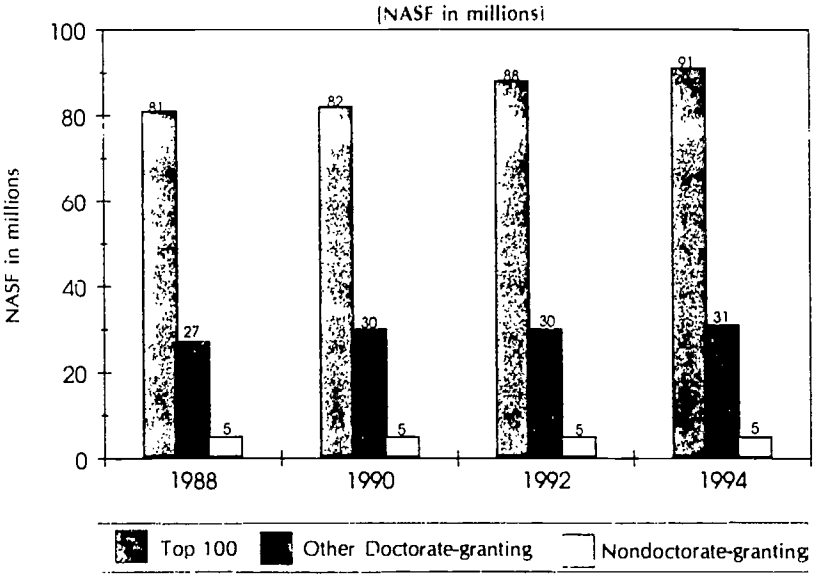
Table 1-3. Trends in the amount of science and engineering research space by institution type: 1988–1994
[Net assignable square feet in millions]

Institution type	1988	1990	1992	1994
Total	112	116	122	127
Doctorate-granting	107	111	117	122
Top 100 in research expenditures	81	82	88	91
Other	27	30	30	31
Nondoctorate-granting	5	5	5	5

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Most of this increase resulted from steady growth in research space at the top 100 institutions. In 1988, these universities devoted 81 million NASF to research space; by 1994, research space had grown by 10 million NASF in the top 100 universities, to 91 million NASF. Research space in other doctorate-granting institutions also increased between 1988 and 1994, from 27 million NASF to 31 million NASF. Research space at nondoctorate-granting institutions remained constant (Figure 1-2).

Figure 1-2. Total net assignable square feet (NASF) of science and engineering research space remains proportional by institution type
[NASF in millions]



SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

However, the average amount of S&E research space per institution has declined since 1992 (Table 1-4). This decline resulted solely from a decline in the average amount of research space in doctorate-granting institutions that are not in the top 100. At these institutions, the average amount of S&E research space dropped from 154 thousand NASF in 1992 to 141 thousand NASF in 1994. During that same period, the average amount of research space at the top 100 institutions increased from 875 thousand to 910 thousand NASF. At nondoctorate-granting institutions, the average space increased slightly, from 20 thousand to 22 thousand NASF.

Table 1-4. Trends in the amount of science and engineering research space per institution by institution type: 1988–1994
(Mean net assignable square feet in thousands)

Institution type	1988	1990	1992	1994
Total	214	222	232	225
Doctorate-granting	367	380	399	382
Top 100 in research expenditures	806	817	875	910
Other	139	153	154	141
Nondoctorate-granting	20	22	20	22

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

How Much S&E Space Was Leased?

Some universities and colleges lease academic and research space. In 1994, research-performing universities and colleges leased 2 percent of their total S&E research space. (See Table 1-5 on the following page.) In 1994, the top 100 institutions leased the highest percentage of their S&E research space, 4.9 percent, continuing an upward trend from previous years. Other doctorate-granting institutions leased 2 percent of their total S&E research space, and nondoctorate-granting institutions leased less than 1 percent of their total S&E research space.

Table 1-5. Trends in percentage of leased science and engineering (S&E) research space by institution type: 1988–1994
[Percentage of total S&E space that is leased]

Institution type	1988	1990	1992	1994
Total	3.4	3.1	3.9	2.0
Doctorate-granting	3.5	3.2	4.0	3.0
Top 100 in research expenditures	3.5	3.2	4.0	4.9
Other	3.4	3.2	4.0	2.0
Nondoctorate-granting	0.2	0.3	0.8	0.6

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

How Was Research Space Distributed Across S&E Fields?

In 1994, more institutions had research space in the biological sciences (87 percent) and the physical sciences (86 percent) than in any other S&E field. (See Table 1-6 on the following page.) In contrast, 20 percent of all research-performing universities and colleges had research space in the agricultural sciences. However, the total amount of NASF of research space in the agricultural sciences (20 million NASF) was greater than the total in either the physical sciences, the biological sciences, or medical sciences in medical schools (17 million NASF each). Conducting agricultural research, thus, appears to require a relatively large amount of space.

Table 1-6. Trends in the amount of science and engineering research space by field: 1988–1994

Field	Percentage of institutions with S&E research space in the field, 1994	Net assignable square feet							
		Total (in millions)				As a percentage of total S&E research space[1]			
		1988	1990	1992	1994	1988	1990	1992	1994
Total		112	116	122	127	100	100	100	100
Engineering	51	16	17	18	21	14	15	15	16
Physical sciences	86	16	16	16	17	14	14	13	13
Environmental sciences	52	6	6	7	7	6	5	6	6
Mathematics	57	1	1	1	1	1	1	1	1
Computer sciences	59	1	1	2	2	1	1	1	1
Agricultural sciences	20	18	21	20	20	16	18	16	16
Biological sciences—other	87	16	18	17	17	14	16	14	13
Biological sciences—medical school	24	8	9	11	11	7	6	9	8
Medical sciences—other	41	5	5	6	6	4	4	5	5
Medical sciences—medical school	22	14	15	16	17	13	13	13	13
Psychology	73	3	3	3	3	3	3	3	3
Social sciences	66	3	3	3	3	3	3	3	3
Other	12	4	2	2	2	4	2	2	2

[1] Percentages may not total to one hundred due to rounding.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Between 1988 and 1994, most of the growth in S&E research space could be attributed to growth in a few fields. Engineering research space grew the most, from 16 million NASF of research space in 1988 to 21 million NASF in 1994. Medical school space in the biological sciences and medical school space in the medical sciences each grew by 3 million NASF during this period.

The distribution of research across all S&E fields shows growth in the NASF devoted to engineering space. In 1988, engineering occupied 14 percent of all research space; by 1994, engineering occupied 16 percent of this space. The computer sciences and mathematics each occupied 1 percent of all research space in all survey years, the least of all S&E fields.

The top 100 universities were more likely to have research space in every S&E field than other types of institutions. Among the top 100 institutions, 93 percent contained research space in the biological sciences outside of medical schools, and 91 percent had research space in the physical sciences (Table 1-7).[2]

Table 1-7. Percentage of institutions with science and engineering research space by institution type and field: 1994

Field	Total	Institution type		
		Doctorate-granting		Nondoctorate-granting
		Top 100 in research expenditures	Other	
Engineering	51	87	56	33
Physical sciences	86	91	82	87
Environmental sciences	52	81	54	38
Mathematics	57	82	57	46
Computer sciences	59	74	60	52
Agricultural sciences	20	41	13	18
Biological sciences—other	87	93	84	86
Biological sciences—medical school	24	60	32	2
Medical sciences—other	41	67	46	25
Medical sciences—medical school	22	66	26	0
Psychology	73	84	75	66
Social sciences	66	89	65	57

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

[2] The top 100 institutions in research expenditures include several specialized institutions. Thus, not all of these institutions do research in the physical sciences or the biological sciences outside of medical schools.

How Much Space Was Devoted to Facilities for Laboratory Animals?

Scientific research in several fields relies on animals. Federal laws and regulations have been instituted to protect animals used in research and to ensure that the space in which they are kept is adequate (42 U.S.C. 289d and 9 CFR Part 3).

Eighty-seven percent of all research-performing universities and colleges had laboratory animal facilities. Doctorate-granting institutions were more likely to have such facilities than were nondoctorate-granting institutions, 95 percent and 77 percent respectively (Table 1-8).

Table 1-8. Amount and distribution of space for laboratory animal facilities by institution type: 1994

Institution type	Institutions with laboratory animal facilities		Total space in laboratory animal facilities		Research space in laboratory animal facilities	
	Number	Percentage of institutions	Net assignable square feet (NASF) in millions	Percentage of total NASF	NASF in millions	Percentage of NASF
Total	493	87	11.3	100	8.6	76
Doctorate-granting	304	95	10.6	94	8.3	78
Top 100 in research expenditures	96	96	7.8	69	6.4	82
Other	208	95	2.7	24	1.9	70
Nondoctorate-granting	190	77	0.8	7	0.4	50

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

In 1994, research-performing universities and colleges devoted approximately 11.3 million NASF to laboratory animal facilities; of this total space, approximately 8.6 million NASF, or 76 percent was used for research. Doctorate-granting universities contained 10.6 million NASF, or 94 percent of the total animal laboratory space. These institutions used 78 percent of laboratory animal space for research. Nondoctorate-granting institutions had 7 percent of the total laboratory animal space and devoted 50 percent of it to research.

Chapter 2

Adequacy and Condition of Research Space

Highlights . . .

- Forty percent or more of all research-performing institutions indicated inadequate amounts of science and engineering (S&E) research space in engineering, the physical sciences, the biological sciences outside of medical schools, and the medical sciences in medical schools.
- The top 100 institutions in terms of research and development (R&D) expenditures were more likely to report inadequate amounts of S&E research space than other types of research-performing institutions.
- Twenty-six percent of the S&E research space at research-performing institutions was considered to be ". . . suitable for use in the most scientifically sophisticated research."
- A combined total of 17 percent of the S&E research space at research-performing institutions was rated as needing either major repair/renovation or replacement.

Context

The amount of S&E research space at research-performing universities and colleges increased steadily between 1988 and 1994, particularly within the top 100 universities. Growth in the amount of S&E research space does not necessarily mean, however, that enough space exists to meet research needs in all S&E fields; nor does it mean that the condition of existing space is suitable for conducting competitive research. This chapter examines assessments, both currently and over time, of the amount of S&E research space and its condition.

The Survey Questions

Amount of Research Space

Respondents were asked to rate the amount of research space in each field by choosing one of the following:

A Adequate amount; sufficient to support all the needs of your research in the field;

B Generally adequate amount; sufficient to support most of your research needs in the field but may have some limitations;

C Inadequate amount; not sufficient to support the needs of your research in the field;

D Nonexistent space but needed; or

E Not applicable or not needed.

(See Item 2 of the survey in Appendix C.)

In this report, inadequate space is defined as either category C, inadequate amount, or category D, nonexistent space but needed.

Condition of Research Space

For each field, institutional respondents reported the percentage of space falling into one of the following categories:

A Suitable for use in the most highly developed and scientifically sophisticated research in the field;

B Effective for most purposes but not applicable to category A;

C Effective for some purposes but in need of limited renovation or repair;

D Requires major repair or renovation to be used effectively;

E Requires replacement; or

NA Not applicable or no research space in this field.

(See Item 3 of the survey in Appendix C.)

To determine the overall amount and percentage of space that was rated in each of the above-listed categories, the amount of research space in each field (reported in Item 1a) was multiplied by the percentage of space reported in each of the above categories and totaled across fields. For example, if a university had 1,000 net assignable square feet (NASF) of research space in environmental sciences and 20 percent of this space "requires replacement," 200 NASF (1,000 x .20) was considered to require replacement. These calculations were performed for each field and each institution and summed to provide the total amount of space meeting each condition. The amount of space meeting each condition was then divided by the total research NASF to provide an overall percentage.

Data Considerations

The survey measures both the adequacy of the amount of S&E research space and the condition of this space in each S&E field. Responses are based on the assessments of a variety of different individuals, including the survey coordinator at the institution, deans, and other administrators. The two questions gathering information about the adequacy of the amount of research space and its condition thus elicit more subjective responses than do other survey items.

Findings

Was the Amount of S&E Research Space Sufficient for Current Research Programs?

Universities and colleges were more likely to rate research space as inadequate in some S&E fields than in others. Forty percent or more of all institutions indicated inadequate amounts of S&E research space in engineering, the physical sciences, the biological sciences outside of medical schools, and the medical sciences in medical schools (Table 2-1).

Table 2-1. Percentage of institutions reporting inadequate amounts of science and engineering research space in existing fields by institution type and field: 1994[1]

Field	Total	Institution type		
		Doctorate-granting		Nondoctorate-granting
		Top 100 in research expenditures	Other	
Engineering	40	55	35	35
Physical sciences	41	51	46	32
Environmental sciences	33	41	34	27
Mathematics	28	32	19	35
Computer sciences	36	43	30	39
Agricultural sciences	30	37	29	24
Biological sciences—other	40	51	32	38
Biological sciences—medical school	37	49	24	-
Medical sciences—other	38	43	41	30
Medical sciences—medical school	44	55	35	-
Psychology	31	31	25	37
Social sciences	29	38	26	27

[1] Includes both "inadequate amount" and "nonexistent space, but needed."

KEY: "-" = Number of institutions less than 5; included in total.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

The top 100 institutions had considerably more S&E research space than any other type of institution (see Table 1-1, page 1-4); and they were generally more likely to indicate that the existing amount of S&E research space was inadequate. The two exceptions were in mathematics and psychology, fields in which more nondoctorate-granting than doctorate-granting institutions rated S&E research space as inadequate.

In four fields, over half of the top 100 institutions reported inadequate amounts of S&E research space: engineering (55 percent); the medical sciences in medical schools (55 percent); the physical sciences (51 percent); and the biological sciences outside of medical schools (51 percent).

What Was the Condition of S&E Research Space?

Of the S&E research space at institutions (see Table 1-1, page 1-4), 26 percent (33 million NASF) of the S&E research space at universities and colleges was rated "suitable for use in the most scientifically sophisticated research." Twenty-seven percent of the S&E research space at both categories of doctorate-granting institutions was rated this way, and 16 percent of the S&E research space at nondoctorate-granting institutions was rated this way (Table 2-2).

Table ... Institutional assessment of quality condition of science and engineering research facilities by institution type: 1994

Percentage of space

Institution type	Suitable for use in most scientifically sophisticated research	Effective for most uses, but not most sophisticated	Needs limited repair/ renovation	Requires major repair/ renovation	Requires replacement	Total
Total	26	33	23	13	4	100
Doctorate-granting	27	32	23	13	4	100
Top 100 in research expenditures	27	32	23	13	5	100
Other	27	35	23	12	2	100
Nondoctorate-granting	16	42	26	14	2	100

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Universities and colleges classified a total of 17 percent of their S&E research space as needing either major repair/renovation (13 percent) or replacement (4 percent). There was general consistency among institutions in the percentage of S&E research space assessed as needing major repair/renovation or replacement. A total of 18 percent of the S&E research space at the top 100 institutions was rated as needing major repair/renovation or replacement; a total of 14 percent of the S&E research space at other doctorate-granting institutions and a total of 16 percent at nondoctorate-granting institutions were rated as needing major repair/renovation or replacement.

These similar percentages, however, mask large differences in the actual amounts of space rated as needing major repair/renovation or replacement. The 18 percent of all S&E research space that the top 100 institutions rated in this way represented 16.4 million NASF in 1994; the 16 percent of S&E research space that the nondoctorate-granting institutions rated this way represented 800 thousand NASF. In total, 21.6 million NASF in research-performing institutions needed major repair/renovation or replacement.

What Percentage of the Total Amount of Research Space in Each Field Required Either Repair/Renovation or Replacement?

In 1994, a higher percentage of the total S&E research space in the agricultural sciences, 22 percent, needed major repair/renovation or replacement than any other field. (See Table 2-3 on the following page.) While 20 percent of all research-performing colleges and universities had agricultural research space, this field accounted for a large share of S&E research space, 20 million NASF. (See Table 1-6, page 1-9.) Thus, this relatively large need was concentrated in a small number of institutions.

Table 2-3. Trends in the percentage of total stock of science and engineering research space requiring repair renovation or replacement by field: 1988–1994

Field	1988	1990	1992[1]	1994[1]
Engineering	14	15	13	15
Physical sciences	18	17	15	18
Environmental sciences	15	15	12	19
Mathematics	6	8	5	6
Computer sciences	16	8	7	6
Agricultural sciences	20	22	26	22
Biological sciences—other	15	14	15	19
Biological sciences—medical school	13	13	15	15
Medical sciences—other	15	17	17	17
Medical sciences—medical school	17	13	17	17
Psychology	12	12	10	13
Social sciences	11	10	13	11

[1] Includes both "requires major repair or renovation" and "requires replacement."

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

In addition to agricultural sciences (22 percent), fields in which 15 percent or more of the total S&E research space needed major repair/renovation or replacement included the following: engineering (15 percent); the physical sciences (18 percent); the environmental sciences (19 percent); the biological sciences, both in medical schools (15 percent) and outside of medical schools (19 percent); and the medical sciences, both within and outside of medical schools (17 percent for each). At this point, there are no evident trends in repair/renovation needs across S&E fields.

What Was the Condition of Facilities for Laboratory Animals?

Across all research-performing universities and colleges, 84 percent of the research NASF for animal facilities met government regulations. Seven percent needed major repair/renovation or replacement in order to meet these standards. There was very little variation across institutions in the percentage of laboratory animal space that either met or did not meet government regulations. (See Table 2-4 on the following page.)

Table 2-4. Percentage of animal care research space meeting government regulations by institutional type: 1994[1]

Institution type	Fully meets government regulations	Needs limited repair/renovation to meet government regulations	Needs major repair/renovation to meet government regulations
Total	84	9	7
Doctorate-granting	84	10	7
Top 100 in research expenditures	83	11	7
Other	87	6	7
Nondoctorate-granting	88	8	4

[1] Percentages may not total to 100 due to rounding.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Chapter 3

New Construction and Repair/ Renovation

Highlights . . .

- In fiscal years 1992–1993, expenditures on projects to construct science and engineering (S&E) research space in research-performing universities and colleges totaled $2,812 million. This amount represents a decline of $290 million in constant dollars (that is, adjusted for inflation) from the previous two fiscal years. This amount also represents the first decline in construction spending since the National Science Foundation (NSF) began collecting data on S&E research facilities in 1986.

- Expenditures on projects to repair/renovate S&E research space also declined from fiscal years 1990–1991 levels. In fiscal years 1992–1993, research-performing universities and colleges spent $837 million to repair/renovate S&E research space. In fiscal years 1990–1991, these institutions spent $861 million (in constant dollars). This overall decline resulted from a drop in the amount spent on such projects by the top 100 institutions in research and development (R&D) expenditures.

- In fiscal years 1992–1993, the biological sciences and the medical sciences accounted for over half of all construction dollars as well as repair/renovation dollars spent for S&E research facilities.

- Fifty-five percent of all research-performing universities and colleges were either constructing S&E research facilities or repairing/renovating their S&E research space during fiscal years 1992-1993.

Context

Studies of higher education institutions have noted the declining state of the physical facilities across university and college campuses. (See Appendix D, *References*, for more detailed information.) Budgetary constraints have forced many institutions to defer construction of facilities and maintenance of older buildings. As a result, many of these institutions now have less than satisfactory academic and research space. Furthermore, changes in technology that have altered the way in which research is conducted and students are trained in S&E fields have put additional pressures on the nation's universities and colleges to update and replace buildings. This chapter examines the extent to which research-performing universities and colleges are constructing S&E research facilities and repairing/renovating S&E research space.

The Survey Questions

Institutions were asked to estimate the research-related cost and space for construction and repair/renovation projects begun during fiscal years 1992–1993 and to make the same estimates for projects planned for fiscal years 1994–1995. Project start was defined as the institution's fiscal year in which actual construction or repair/renovation work began or was expected to begin. In the case of multiyear projects, total project costs were allocated to the fiscal year in which the construction or repair/renovation actually began.

The reported costs, defined as the cost to complete a project, included planning, construction, and fixed equipment. Projects over $100,000 and under $100,000 were reported separately. If a project was to serve both research and nonresearch purposes, the construction costs and space estimates were to be prorated to reflect the research-related portion of the cost. (See Item 4a and Item 7 of the survey in Appendix C.)

Data Considerations

Data reported in this chapter reflect the extent of construction and repair/renovation activity underway in fiscal years 1992–1993. Tables that report expenditures or costs over time are presented in constant and current dollars but discussed only in terms of 1993 constant dollars. Constant dollars are "inflation adjusted" dollars and compensate for variations in the purchasing power of the dollar over time. Constant dollars thus adjust for the fact that what $100 will buy today is not the same as what $100 would purchase ten years ago or even one year ago.

The specific deflator used in this chapter is the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction which more closely tracks inflation within the construction industry than a more general index does. The fixed-weighted price index reflects changes in prices and remains unaffected by changes in the mix of construction projects during any given year. (See Appendix A, *Technical Notes*, for further discussion of the price index.)

Previous reports presented trends in current dollars; however, comparisons in current dollars tend to overstate increases in spending over time because more current dollars are needed to buy the same products each year. In this report, trends are reported in constant dollars.and provide a more accurate picture of expenditure trends.

Throughout this chapter, as well as the rest of the report, the term "capital projects" refers to either construction projects or repair/renovation activities. Construction always refers to building facilities that currently do not exist; repair/renovation implies remodeling or restoring existing facilities.

Findings

How Much Did Institutions Spend on Construction and Repair/Renovation Projects?

In fiscal years 1992–1993, expenditures for S&E research space construction projects in research-performing institutions totaled $2,812 million. This amount represented a decline of $290 million from the previous two fiscal years. This amount also represented the first decline in construction spending since NSF began collecting data on S&E research facilities. (See Table 3-1 and Table 3-2 on the following page.)

Table 3-1. Trends in expenditures to construct science and engineering research facilities by institution type: 1986–1995
[Constant 1993 dollars in millions][1]

Institution type	1986–1987	1988–1989	1990–1991	1992–1993	1994–1995 (Planned)
Total	2,377	2,659	3,102	2,812	3,020
Doctorate granting	2,188	2,498	2,967	2,720	2,890
Top 100 in research expenditures	1,853	1,681	2,107	2,029	2,389
Other	334	817	861	691	501
Nondoctorate-granting	189	162	133	92	130

[1] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

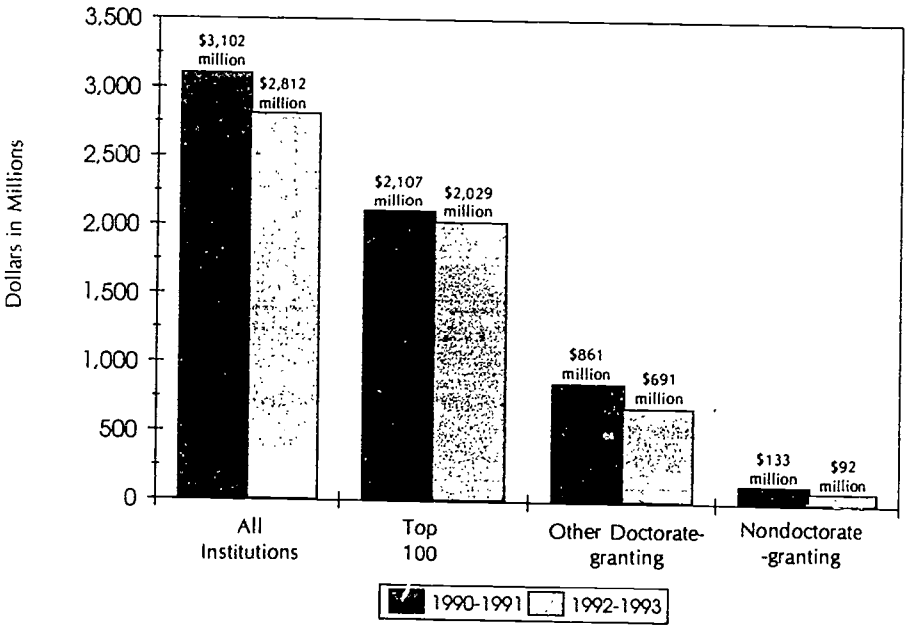
Table 3-2. Trends in expenditures to construct science and engineering research facilities by institution type: 1986–1995
[Current dollars in millions]

Institution type	1986–1987	1988–1989	1990–1991	1992–1993	1994–1995 (Planned)
Total	2,051	2,464	2,976	2,812	3,020
Doctorate-granting	1,888	2,315	2,847	2,720	2,890
Top 100 in research expenditures	1,599	1,558	2,022	2,029	2,389
Other	288	757	826	691	501
Nondoctorate-granting	163	150	128	92	130

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

All types of institutions experienced decreases in construction spending in constant dollars. However, in relative terms, the top 100 experienced the smallest decrease, a 4 percent decline from $2,107 million in fiscal years 1990-1991 to $2,029 million in fiscal years 1992-1993, while the nondoctorate-granting institutions experienced the largest decrease, 31 percent from$133 million to $92 million during the same period. (See Figure 3-1 on the following page.)

Figure 3-1. Dollars for construction projects for science and engineering research space declined since fiscal years 1990-1991
[Constant 1993 dollars in millions]



SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Expenditures for repair/renovation projects costing over $100,000 also declined from fiscal years 1990–1991 levels. In fiscal years 1992–1993, research-performing universities and colleges spent $837 million to repair/renovate S&E research space. In fiscal years 1990–1991, these institutions spent $861 million. This overall decline resulted from a drop in what the top 100 institutions spent: $660 million in fiscal years 1990–1991 and $623 million in fiscal years 1992–1993. (See Table 3-3 and Table 3-4 on the following page.)

Table 3-3. Trends in expenditures for capital projects costing over $100,000 to repair/renovate science and engineering research facilities by institution type: 1986–1995
[Constant 1993 dollars in millions][1]

Institution type	1986–1987	1988–1989	1990–1991	1992–1993	1994–1995 (Planned)
Total	971	1,090	861	837	978
Doctorate-granting	919	1,056	828	803	914
Top 100 in research expenditures	691	521	660	623	668
Other	228	535	168	180	246
Nondoctorate-granting	52	32	33	34	64

[1] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Table 3-4. Trends in expenditures for capital projects costing over $100,000 to repair/renovate science and engineering research facilities by institution type: 1986–1995
[Current dollars in millions]

Institution type	1986–1987	1988–1989	1990–1991	1992–1993	1994–1995 (Planned)
Total	838	1,010	826	837	978
Doctorate-granting	793	979	794	803	914
Top 100 in research expenditures	596	483	633	623	668
Other	197	496	161	180	246
Nondoctorate-granting	45	30	32	34	64

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Other doctorate-granting institutions spent approximately $12 million more in fiscal years 1992–1993 than in the two previous fiscal years to repair/renovate S&E research space, while the spending of nondoctorate-granting institutions remained stable.

Expenditures for S&E research facility repair/renovation projects costing less than $100,000 told a somewhat different story. Expenditures increased by two-thirds, from $152 million in fiscal years 1990–1991 to $241 million in fiscal years 1992–1993. Other doctorate-granting institutions were the only type of institution that experienced a decline in these types of expenditures. (See Table 3-5 on the following page.)

Table 3-5. Trends in expenditures for science and engineering research facilities repair/renovation projects costing less than $100,000 by institution type: 1990–1993
[Constant 1993 dollars in millions[1]]

Institution type	1990–1991	1992–1993
Total	152	241
Doctorate-granting	147	208
Top 100 in research expenditures	101	179
Other	46	29
Nondoctorate-granting	5	33

[1] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

How Much Did Institutions Spend on Construction and Repair/Renovation of S&E Research Space in Different Fields?

The biological sciences and the medical sciences accounted for over half of all construction dollars spent by research-performing universities and colleges in fiscal years 1992–1993. (See Table 3-6 on the following page.) Overall, $2,812 million were spent; academic institutions spent $999 million to construct research space in the medical sciences and $633 million to construct research space in the biological sciences. Within each of these fields, the majority of the construction dollars went to construction of medical facilities.

Table 3-6. Trends in expenditures for capital projects to construct science and engineering research facilities by field: 1986–1995
(Constant 1993 dollars in millions)[1]

Field	1986–1987	1988–1989	1990–1991	1992–1993	1994–1995 (Planned)
Total	2,377	2,659	3,102	2,812	3,020
Engineering	498	419	412	286	550
Physical sciences	211	433	448	337	364
Environmental sciences	66	88	177	123	55
Mathematics	2	9	13	10	11
Computer sciences	71	70	42	47	83
Agricultural sciences	174	164	182	210	281
Biological sciences	537	623	867	633	676
other	376	427	470	292	277
medical schools	161	195	397	341	399
Medical sciences	585	698	841	999	813
other	235	66	157	160	177
medical schools	350	633	683	839	636
Psychology	27	27	38[2]	16	50
Social sciences	44	52		44	66
Other	161	76	83	103	71

[1] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

[2] Psychology and social sciences were not differentiated in the questionnaire item for the 1990–1991 period.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Institutions spent the next largest amounts of money to construct research space in the physical sciences, $337 million, followed by engineering, $286 million, and the agricultural sciences, $210 million. The largest increase in spending for construction of S&E research space between fiscal years 1990–1991 and fiscal years 1992–1993 occurred within the medical sciences, from $841 million to $999 million.

Most S&E fields experienced a decline in construction spending. Spending on engineering construction, for example, dropped from $412 million in fiscal years 1990–1991 to $286 million in fiscal years 1992–1993. Spending to construct research space in the physical sciences declined from $448 million to $337 million. Despite the relatively high level of funding in fiscal years 1992–1993 to construct research space in the biological sciences, spending in this field dropped over $200 million, from $867 million in fiscal years 1990–1991 to $633 million in fiscal years 1992–1993.

Repair/renovation spending for research space across S&E fields demonstrated similar patterns. In fiscal years 1992–1993, research-performing institutions spent more to repair/renovate S&E research space in the medical sciences ($262 million) and the biological sciences ($224 million) than in any other S&E field (Table 3-7). As was the case with construction, the majority of repair/renovation dollars within these two fields went to research space in medical schools.

Table 3-7. Trends in expenditures for capital projects to repair renovate science and engineering research facilities by field: 1986–1995
(Constant 1993 dollars in millions)[1]

Field	1986–1987	1988–1989	1990–1991	1992–1993	1994–1995 (Planned)
Total	971	1,090	861	837	978
Engineering	163	390	85	139	152
Physical sciences	122	178	157	134	202
Environmental sciences	24	19	17	31	17
Mathematics	5	12	6	2	8
Computer sciences	20	10	22	4	23
Agricultural sciences	23	25	36	14	79
Biological sciences	261	217	270	224	226
other	169	136	141	108	146
medical schools	90	82	128	116	80
Medical sciences	262	200	228	262	241
other	60	26	55	28	39
medical schools	202	174	173	234	202
Psychology	16	12	32[2]	10	12
Social sciences	42	9		10	14
Other	35	18	6	7	4

[1] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

[2] Psychology and social sciences were not differentiated in the questionnaire item for the 1990–1991 period.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Research-performing universities and colleges spent $139 million to repair/renovate engineering research space and $134 million to repair/renovate research space in the physical sciences. In no other individual S&E field did repair/renovation expenditures exceed $40 million.

Some S&E fields experienced increases in spending to repair/renovate research space between fiscal years 1990–1991 and fiscal years 1992–1993, while others experienced declines. The largest increase occurred in engineering. Research-performing universities and colleges spent $85 million to repair/renovate research space in this field in fiscal years 1990–1991 and $139 million the following two fiscal years. Despite a large share of all repair/renovation dollars, the biological sciences experienced the largest decrease, from $270 million in fiscal years 1990–1991 to $224 million in fiscal years 1992–1993.

To What Extent Were Universities and Colleges Involved in Capital Projects?

During fiscal years 1992–1993, 55 percent of all research-performing institutions undertook some type of S&E capital project costing over $100,000, either construction or repair/renovation (Table 3-8). Ninety-five percent of the top 100 institutions began some type of capital project during this period. Fifty-seven percent of other doctorate-granting universities, and 35 percent of nondoctorate-granting institutions undertook such projects.

Table 3-8. Percentage of institutions doing construction or repair renovation to science and engineering research space by institution type: 1992–1993

Institution type	Percentage of institutions doing either construction or repair/renovation	Percent doing construction	Percent doing repair/ renovation
Total	55	32	46
Doctorate-granting	69	44	61
Top 100 in research expenditures	95	79	90
Other	57	28	48
Nondoctorate-granting	35	15	25

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Regardless of the type of institution, universities and colleges were more likely to have begun repair/renovation projects than construction projects. Doctorate-granting institutions were more likely to have begun both repair/renovation and construction projects than were nondoctorate-granting institutions.

Did Capital Project Activity Change over Time?

Overall, the percentage of research-performing universities and colleges engaged in either the construction of S&E research space or the repair/renovation of S&E research space fluctuated somewhat over time. The level of construction activity in doctorate-granting universities increased between fiscal years 1986–1987 and fiscal years 1990–1991, but dropped considerably in fiscal years 1992–1993 (Table 3-9). In fiscal years 1990–1991, 57 percent of all doctorate-granting universities began some type of construction project, but in fiscal years 1992–1993, 44 percent of these institutions began construction projects. This decrease can be accounted for by the rather sharp drop in the percentage of other doctorate-granting institutions (those not in the top 100) that began construction projects. In fiscal years 1990–1991, 45 percent of these institutions began construction projects; in fiscal years 1992–1993, 28 percent did so.

Table 3-9. Trends in percentage of institutions starting capital projects to construct science and engineering research facilities by institution type: 1986–1995

Institution type	1986–1987	1988–1989	1990–1991	1992–1993	1994–1995 (Planned)
Total	37	44	37	32	30
Doctorate granting	47	53	57	44	43
Top 100 in research expenditures	72	71	81	79	80
Other	34	44	45	28	26
Nondoctorate-granting	25	32	12	15	14

NOTE: As used here, capital projects are construction or repair/renovation projects with prorated costs of $100,000 or more for affected research space. Percentages are based on number of institutions with some science and engineering research space.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

For nondoctorate-granting institutions, the drop in construction project starts occurred between fiscal years 1988–1989 and fiscal years 1990–1991, a decline from 32 percent to 12 percent.

Not only was there a decline in the percentage of institutions undertaking S&E research construction projects between fiscal years 1990–1991 and fiscal years 1992–1993, but no increase was planned for fiscal years 1994–1995. (See Table 3-9.) In fiscal years 1992–1993, 32 percent of research-performing institutions constructed S&E research space; for fiscal years 1994–1995, 30 percent planned to undertake construction projects.[1]

As construction activity dropped at other doctorate-granting institutions, repair/renovation activity also dropped sharply at the same institutions. In fiscal years 1988–1989 and fiscal years 1990–1991, 65 percent of other doctorate-granting institutions were repairing/renovating some S&E research space (Table 3-10).

Table 3-10. Trends in percentage of institutions starting capital projects to repair/renovate science and engineering research facilities by institution type: 1986–1995

Field	1986–1987	1988–1989	1990–1991	1992–1993	1994–1995 (Planned)
Total	56	48	47	46	41
Doctorate-granting	78	71	74	61	57
Top 100 in research expenditures	96	85	91	90	78
Other	44	63	65	48	47
Nondoctorate-granting	28	20	14	25	20

NOTE: As used here, capital projects are construction or repair/renovation projects with prorated costs of $100,000 or more for affected research space. Percentages are based on number of institutions with some science and engineering research space.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

In fiscal years 1992–1993, 48 percent of the other doctorate-granting institutions were beginning to repair/renovate S&E research space. Planned repair/renovation projects to S&E research space for fiscal years 1994–1995 were also down from fiscal years 1992–1993. (See Table 3-10.) Forty-six percent of all institutions undertook repair/renovation projects to S&E research space in fiscal years 1992–1993; 41 percent planned such projects for fiscal years 1994–1995.[1]

[1] A comparison of the levels of planned construction with actual activity across survey years reveals that actual construction activity was generally less than what institutions reportedly planned to undertake two years prior. Comparisons of planned and actual repair/renovation activity were more mixed.

In What Fields Were Capital Projects Undertaken?

Both construction and repair/renovation projects were more likely to have occurred in certain S&E fields than others. This was the case for the most recent fiscal years as well as in prior years. In fiscal years 1992–1993, one-third of the research-performing institutions with medical schools and with S&E space in the medical sciences began construction projects. In fiscal years 1992–1993, those institutions with research space in the agricultural sciences were also heavily engaged in constructing S&E facilities; 27 percent of these universities and colleges had such projects underway. Other S&E fields in which at least 10 percent of research-performing institutions began construction projects in fiscal years 1992–1993 were engineering (17 percent); both the biological sciences outside of medical schools (10 percent) and those in medical schools (20 percent); and medical sciences outside of medical schools (11 percent) (Table 3-11).

Table 3-11. Trends in percentage of institutions starting capital projects to construct science and engineering research facilities by field: 1986–1995

Field	1986–1987	1988–1989	1990–1991	1992–1993	1994–1995 (Planned)
Total	37	44	37	33	32
Engineering	28	18	16	17	18
Physical sciences	9	15	11	9	10
Environmental sciences	9	6	15	9	6
Mathematics	1	2	4	2	2
Computer sciences	8	6	7	4	4
Agricultural sciences	38	33	30	27	23
Biological sciences—other	9	19	10	10	8
Biological sciences—medical school	20	26	33	20	9
Medical sciences—other	7	5	13	11	9
Medical sciences—medical school	32	23	41	33	29
Psychology	5	3	7[1]	2	2
Social sciences	5	4		3	3

[1] Psychology and social sciences were not differentiated in the questionnaire items for the 1990–1991 period.

NOTE: As used here, capital projects are construction or repair/renovation projects with prorated costs of $100,000 or more for affected research space. Percentages are based on number of institutions with some science and engineering research space.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Repair/renovation projects to S&E research space were also most likely to have been started in the medical sciences within medical schools. Sixty-one percent of all research-performing universities and colleges that had research space in this field either repaired or renovated some portion of this research space. Medical schools were also active in repairing research space in the biological sciences (39 percent). At least one-fifth of research-performing universities and colleges repaired research space in engineering (30 percent); the physical sciences (22 percent); and the biological sciences outside of medical schools (22 percent) (Table 3-12).

Table 3-12. Trends in percentage of institutions starting capital projects to repair/renovate science and engineering research facilities by field: 1986–1995

Field	1986–1987	1988–1989	1990–1991	1992–1993	1994–1995 (Planned)
Total	56	48	47	45	41
Engineering	42	37	24	30	23
Physical sciences	22	23	22	22	18
Environmental sciences	13	9	13	13	9
Mathematics	8	8	4	2	4
Computer sciences	15	5	10	6	5
Agricultural sciences	33	25	27	18	19
Biological sciences—other	23	24	22	22	21
Biological sciences—medical school	45	41	46	39	25
Medical sciences—other	12	12	22	16	17
Medical sciences—medical school	54	44	62	61	45
Psychology	9	4	10[1]	4	4
Social sciences	8	5		5	5

[1] Psychology and social sciences were not differentiated in the questionnaire items for the 1990–1991 period.

NOTE: As used here, capital projects are construction or repair/renovation projects with prorated costs of $100,000 or more for affected research space. Percentages are based on number of institutions with some science and engineering research space.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Over time, for construction as well as repair/renovation activities, the level of activity by S&E field fluctuated, indicating that research-performing universities and colleges may focus efforts and resources on specific S&E fields in certain years. As an example, 28 percent of all academic institutions started projects to construct research space in engineering in fiscal years 1986–1987. In fiscal years 1988–1989, 18 percent started construction projects in this field, and the percentages were similar in fiscal years 1990–1991. (See Table 3-11.) Similarly, the percentage of institutions that started repair/renovation to agricultural research space declined from 27 percent in fiscal years 1990–1991 to 18 percent in fiscal years 1992–1993. (See Table 3-12.)

The fields in which institutions planned to construct S&E research space or to repair/renovate space in fiscal years 1994–1995 were similar to those in which projects were undertaken in fiscal years 1992–1993. Universities with medical schools still planned to be active in constructing space (29 percent of these institutions had plans for such projects in fiscal years 1994–1995) and in repairing/renovating space (45 percent planned to undertake such projects).

What Did Institutions Plan to Spend on Animal Facilities?

Research-performing universities and colleges planned to spend over $294 million on construction and repair/renovation projects for laboratory animal facilities in fiscal years 1994–1995. Ninety-one percent of these planned expenditures, $266.5 million, were accounted for by the top 100 universities. Nondoctorate-granting universities planned to spend $1.7 million, or less than 1 percent of the total (Table 3-13).

Table 3-13. Cost of planned construction and repair/renovation for laboratory animal facilities by institution type: 1994–1995
[Dollars in millions]

Institution type	Cost of planned construction and repair/renovation
Total	294.2
Doctorate-granting	292.4
Top 100 in research expenditures	266.5
Other	25.9
Nondoctorate-granting	1.7

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Chapter 4

Funding of Research Facilities Projects

Highlights . . .

- For public universities and colleges, state and local governments continued to be the largest single funding source of science and engineering (S&E) research facilities construction projects, contributing $930 million, or 46 percent of all funds for fiscal years 1992–1993.
- State and local governments also contributed 46 percent of all dollars for repairing/renovating S&E research facilities in public universities and colleges. Their contributions totaled $237 million in fiscal years 1992–1993.
- For private universities and colleges, total institutional contributions (institutional funds, tax exempt bonds, and other debt) provided over half (54 percent) of the funds for construction projects for S&E research space in fiscal years 1992–1993.
- Private universities and colleges also relied heavily on institutional contributions to fund S&E research repair/ renovation projects in fiscal years 1992–1993. Seventy-two percent of the total repair/renovation funding, $225 million, came from these institutional contributions.

Context

Although research-performing universities and colleges were involved in considerable capital project activity in fiscal years 1992–1993, both the construction of facilities and the repair/renovation of S&E research space declined somewhat from the previous two fiscal years. The amounts and relative proportions of money received from different funding sources varied over time, possibly reflecting changes in both the economy and the types of projects undertaken. This chapter examines how higher education institutions financed S&E capital projects between 1986 and 1993, with particular attention to declines in specific funding sources.

The Survey Question

Institutional respondents were asked to report funding sources for projects to construct S&E research facilities and to repair/renovate S&E research space. Respondents reported only the projects that cost over $100,000. These projects were to have begun in fiscal years 1992–1993. Possible sources included the Federal government, state or local governments, private donations, institutional funds, tax-exempt bonds, other debt financing, and other sources. (See Item 5 of the survey in Appendix C.)

Data Considerations

Institutions reported only on construction and repair/renovation projects that were for S&E research space and that exceeded $100,000. Within the seven funding categories provided on the survey, considerable diversity is possible. For example, Federal funding can include specific facilities support programs administered by the National Science Foundation (NSF) and the National Institutes of Health (NIH). Federal funding might also include non-peer-reviewed projects that are specified individually through Congressional legislation rather than specific agency programs. There may be some overlap in the categories as well. For example, indirect costs included as institutional funds can come from Federal, state, and local governments.

No information was gathered in the survey that distinguished indirect cost recovery from other institutional funding, such as the use of operating or endowment funds.

In this report, all dollar figures for years prior to 1993 were adjusted using the Bureau of Census' Composite Fixed-Weighted Price Index for Construction. This adjustment means that dollar figures presented in this report do not match the previous reports' figures, which were in current dollars.

Findings

How Did Institutions Fund Capital Projects?

Type of Institution

For doctorate-granting institutions, the decline in combined costs for the construction of S&E research space and the repair/renovation of research space between fiscal years 1990–1991 and the following two fiscal years resulted from declines in nearly all funding categories (Table 4-1). Other debt and other funding sources increased, but the relative contribution of these two sources was small.

Table 4-1. Trends in the sources of funding for capital projects to construct and repair/renovate science and engineering research facilities by institution type: 1986–1993
[Constant 1993 dollars in millions][1]

Institution type and time period	Total	Government		Private donations	Institutional funds	Tax-exempt bonds	Other debt	Other sources
		Federal	State/local					
Doctorate-granting:								
1986–1987	3,106	177	1,033	651	712	478	8	45
1988–1989	3,555	426	1,116	490	973	421	121	6
1990–1991	3,795	536	1,225	465	768	719	45	38
1992–1993	3,522	499	1,137	363	698	695	66	64
Nondoctorate-granting:								
1986–1987	241	22	139	31	5	45	0	0
1988–1989	194	19	98	63	14	0	0	0
1990–1991	167	13	26	8	14	108	0	0
1992–1993	124	16	84	11	7	6	0	2

[1] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price for Construction.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

For nondoctorate-granting institutions, combined construction and repair/ renovation expenses for projects involving S&E research space decreased steadily, in constant dollars, from fiscal years 1986–1987 to fiscal years 1992–1993. In fiscal years 1992–1993, nondoctorate-granting institutions spent $124 million for capital projects. Furthermore, nondoctorate-granting institutions spent about 3 percent of what doctorate-granting universities did for these same types of projects.

Although Federal support to doctorate-granting universities for capital projects entailing S&E research space declined between fiscal years 1990–1991 and fiscal years 1992–1993, from $536 million to $499 million, the Federal government still provided these institutions with considerably more money than in either fiscal years 1986–1987 or fiscal years 1988–1989. (These dollar figures have been adjusted for inflation.)

State and local government support to doctorate-granting institutions for S&E research space capital projects dropped slightly between fiscal years 1990–1991 and fiscal years 1992–1993. For nondoctorate-granting institutions, funds from state and local governments increased from $26 million in fiscal years 1990–1991 to $84 million in fiscal years 1992–1993. This amount was, nevertheless, considerably below fiscal years 1986–1987 funding level of $139 million.

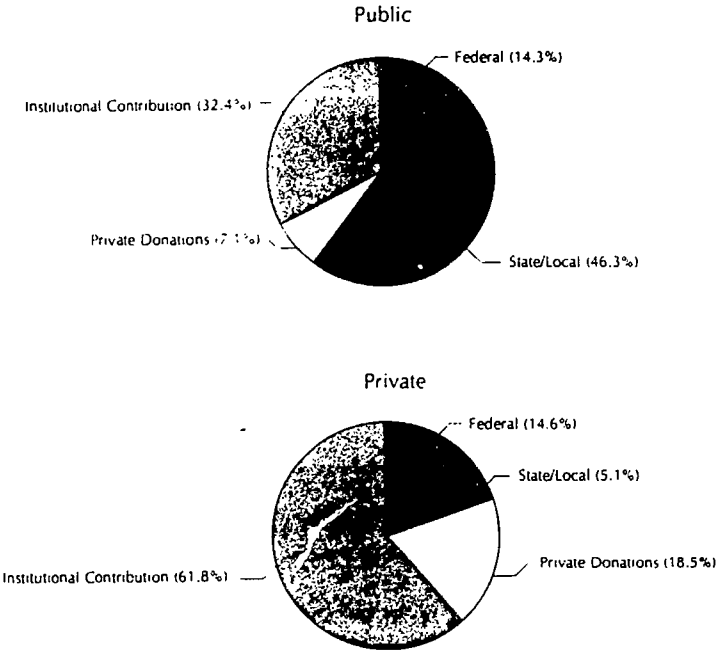
Institutional contributions to capital projects that involved S&E research space occurred through institutional funds, tax-exempt bonds, and other debt. The institutional contribution of doctorate-granting institutions to both construction and repair/renovation of S&E research space was considerably larger in both absolute dollars and relative contribution than that of nondoctorate-granting institutions. Doctorate-granting institutions contributed 41 percent of all construction and repair/renovation dollars; nondoctorate-granting institutions contributed 10 percent.[1]

Control of Institution

Because of the support that state governments provide public higher education institutions, the control of institutions is very relevant to discussions of who funds capital projects involving S&E research space. State governments subsidize over 1,600 universities and colleges in the United States, providing support for operating expenses as well as capital projects. Private institutions, although greater in number, enroll fewer students and cannot rely on state and local governments for capital funding as readily as public universities and colleges. (See Figure 4-1 on the following page.)

[1] These percentages were calculated from data presented in Table 4-1.

Figure 4-1. Public and private institutions have different funding sources of capital projects for construction and repair/renovation of science and engineering research space: 1994



SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

During fiscal years 1992–1993, public universities and colleges spent a total of $2,537 million on the construction and repair/renovation of S&E research space. (See Table 4-2 on the following page.) Since fiscal years 1988–1989, the amount spent on capital projects declined slightly, from $2,618 million to $2,573 million in fiscal years 1990–1991 to $2,537 million in fiscal years 1992–1993.

Table 4-2. Trends in the sources of funding for capital projects to construct and repair/renovate science and engineering research facilities by institution control: 1986–1993
Constant 1993 dollars in millions

Institution control and time period	Total	Government		Private donations	Institutional funds	Tax-exempt bonds	Other debt	Other sources
		Federal	State/local					
Public:								
1986–1987	2,076	61	1,137	318	306	250	2	0.2
1988–1989	2,618	329	1,151	232	712	174	14	1
1990–1991	2,573	430	1,087	191	422	428	8	8
1992–1993	2,537	360	1,167	178	353	446	18	15
Private:								
1986–1987	1,273	138	37	364	410	274	1	39
1988–1989	1,132	117	62	319	275	247	99	2
1990–1991	1,388	117	164	282	360	399	31	28
1992–1993	1,110	155	54	196	352	254	48	51

' Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price for Construction.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

During fiscal years 1992–1993, private universities and colleges spent $1,110 million on construction and repair/renovation projects involving S&E research space. Over the four time periods represented by the surveys, the amount spent on these activities fluctuated slightly from year to year.

For public universities and colleges, state and local governments provided the largest share of funding for S&E research capital projects, $1,167 million. Funds from this source increased between fiscal years 1990–1991 and fiscal years 1992–1993, from $1,087 million to $1,167 million. Funds from tax-exempt bonds also increased slightly during this period, from $428 million to $446 million.

For private universities and colleges in fiscal years 1992–1993, institutional contributions (a total of institutional funds, tax-exempt bonds, and other debt) provided the largest share of funding for capital projects entailing S&E research space, $654 million. Relative to both public institutions and to other funding sources, funds from state and local governments in fiscal years 1992–1993 were small, $54 million. Although the contribution of state and local governments in fiscal years 1992–1993 dropped sharply from the two previous fiscal years, fiscal years 1990–1991 contribution of $164 million should be viewed as an anomaly.

How Did Institutions Fund Construction Projects?

Public Institutions

As was the case in prior years, public universities and colleges relied heavily on state and local support for the construction of S&E research space in fiscal years 1992–1993. For this period, state and local governments provided a total of $930 million or 46 percent of all funds (Table 4-3).

Table 4-3 Trends in public institutions' sources of funding for construction of science and engineering research facilities: 1986–1993

Index and time period	Total	Government		Private donations	Institutional funds	Tax-exempt bonds	Other debt	Other sources
		Federal	State/ local					
	[Constant 1993 dollars in millions][1]							
Dollar contributions:								
1986–1987	1,570	46	874	300	126	220	2	< 1
1988–1989	1,864	296	904	208	276	166	8	1
1990–1991	2,105	404	843	145	281	416	8	7
1992–1993	2,016	326	930	153	198	390	16	3
	[Percentage of total funding]							
Relative contribution:								
1986–1987	100	3	56	19	8	14	< 1	< 1
1988–1989	100	16	49	11	15	9	< 1	< 1
1990–1991	100	19	40	7	13	20	< 1	< 1
1992–1993	100	16	46	8	10	19	1	< 1

[1] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price for Construction.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Federal funding of construction projects for S&E research space increased from a relative contribution of 3 percent in fiscal years 1986–1987 to 16 percent in fiscal years 1992–1993. This increase occurred at a time when private support for S&E research construction at public universities and colleges declined from 19 percent to 8 percent.

For public universities and colleges, the institutional contribution (institutional funds, tax-exempt bonds, and other debt) to construction projects for S&E research space represented 30 percent of all construction dollars in fiscal years 1992–1993.

Private Institutions

For fiscal years 1992–1993, tax-exempt bonds provided private universities and colleges with $230 million for the construction of S&E research facilities or 29 percent of all construction funds (Table 4-4). Although this amount represented a decline from fiscal years 1990–1991 contribution of $343 million, tax-exempt bonds provided private institutions with considerably more funds in fiscal years 1992–1993 than in fiscal years 1986–1987. In fiscal years 1986–1987, tax-exempt bonds provided $144 million (Table 4-4).

Table 4-4. Trends in private institutions' sources of funding for construction of science and engineering research facilities: 1986–1993

Index and time period	Total	Government		Private donations	Institutional funds	Tax-exempt bonds	Other debt	Other sources
		Federal	State/ local					
	[Constant 1993 dollars in millions][1]							
Dollar contributions:								
1986–1987	807	105	29	264	210	144	1	37
1988–1989	796	84	56	287	95	179	95	< 1
1990–1991	996	92	153	223	129	343	29	27
1992–1993	796	133	39	149	177	230	23	46
	[Percentage of total funding]							
Relative contribution:								
1986–1987	100	15	4	33	26	18	<1	5
1988–1989	100	11	7	36	12	22	12	< 1
1990–1991	100	9	15	22	13	34	3	3
1992–1993	100	17	5	19	22	29	3	6

[1] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price for Construction.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Total institutional contributions (institutional funds, tax-exempt bonds, and other debt) provided an increasing percentage of the total funding spent on the construction of S&E research facilities. In fiscal years 1986–1987, institutional contributions provided less than 45 percent of construction funding. By fiscal years 1992–1993, they provided over half, 54 percent, of the funds for S&E research facilities projects.

In fiscal years 1992–1993, the Federal government provided $133 million, or 17 percent of all construction dollars, for S&E research space to private universities and colleges, a proportion similar to that provided to public institutions. In contrast to public institutions, state and local governments provided $39 million, or 5 percent, of the total S&E research construction costs for private institutions for fiscal years 1992–1993.

How Did Institutions Fund Repair/Renovation Projects?

Public Institutions

In fiscal years 1992–1993, state and local governments provided public universities and colleges with $237 million for the repair/renovation of S&E research facilities. (See Table 4-5 on the following page.) As a relative contribution, this amount comprised 46 percent of all repair/renovation funding. The constant dollar contribution from state and local governments decreased between fiscal years 1990–1991 and fiscal years 1992–1993, from $244 million to $237 million. The relative contribution from state and local governments also decreased from 52 percent of all funds for repair/renovation projects to 46 percent.

Table 4-5. Trends in public institutions' sources of funding for repair/renovation of science and engineering research facilities: 1986–1993

Index and time period	Total	Government		Private donations	Institutional funds	Tax-exempt bonds	Other debt	Other sources
		Federal	State/ local					
	[Constant 1993 dollars in millions][1]							
Dollar contributions:								
1986–1987	505	15	263	17	180	30	< 1	< 1
1988–1989	754	33	247	24	436	8	5	0
1990–1991	468	26	244	46	141	13	0	1
1992–1993	520	34	237	25	154	56	2	12
	[Percentage of total funding]							
Relative contribution:								
1986–1987	100	3	52	3	36	6	< 1	< 1
1988–1989	100	4	33	3	58	1	1	0
1990–1991	100	5	52	10	30	3	0	< 1
1992–1993	100	5	46	5	30	11	< 1	2

[1] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price for Construction.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

In fiscal years 1992–1993, institutional funds provided $154 million or 30 percent of all repair/renovation dollars for S&E research space. When tax-exempt bonds and other debts are considered, public institutions made an institutional contribution of over 40 percent of all funds for the repair/renovation of S&E research space. The Federal government provided 5 percent of all funding for the repair/renovation of S&E research facilities.

Private Institutions

In all years covered by the surveys, private universities and colleges funded a substantial portion of their S&E repair/renovation projects with relatively little Federal, state, or local government support (12 percent). In fiscal years 1992–1993, institutional contributions (institutional funds, tax-exempt bonds, and other debt) provided $225 million, or 72 percent, of all repair/renovation costs. (See Table 4-6 on the following page.)

Table 4-6. Trends in private institutions' sources of funding for repair/renovation of science and engineering research facilities: 1986–1993

Index and time period	Total	Government		Private donations	Institutional funds	Tax-exempt bonds	Other debt	Other sources
		Federal	State/local					
	[Constant 1993 dollars in millions][1]							
Dollar contributions:								
1986–1987	469	16	8	99	200	129	5	8
1988–1989	336	32	5	32	180	68	12	5
1990–1991	391	25	10	59	230	56	8	3
1992–1993	315	22	15	48	176	24	25	4
	[Percentage of total funding]							
Relative contribution:								
1986–1987	100	4	2	21	43	28	1	2
1988–1989	100	10	1	10	54	20	4	2
1990–1991	100	6	3	15	59	14	2	1
1992–1993	100	7	5	15	56	8	8	1

[1] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price for Construction.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

In fiscal years 1992–1993, private donations totaled $48 million or 15 percent of the total amount spent to repair/renovate S&E research space. The relative contribution of the Federal government was similar for private (7 percent) as for public institutions (5 percent). However, private institutions received considerably less in constant dollars ($22 million) than public institutions ($34 million). In fiscal years 1992–1993, state and local governments provided 5 percent of all S&E research repair/renovation dollars to private universities and colleges.

Chapter 5

Deferred Construction and Repair/ Renovation

Highlights . . .

- Of all research-performing universities and colleges, 40 percent reported an approved institutional plan that included deferred or unfunded construction or repair/ renovation projects for science and engineering (S&E) research space. (See Appendix A, *Technical Notes*.)
- Based on these reports from institutions, the estimated cost for deferred construction projects for S&E research space was $4,047 million; the estimated cost for deferred repair/renovation projects for S&E research space was $1,697 million. These estimates directly reflected the needs of the 40 percent of universities and colleges that had identified these deferred needs in an approved institutional plan.
- Five fields were mentioned by at least 10 percent of the research-performing universities and colleges that reported deferred needs in S&E research space: agricultural sciences, engineering, the physical sciences, medical sciences in medical schools, and biological sciences outside of medical schools.

Context

Previous chapters have provided information about the amount of S&E research space available in research-performing universities and colleges (see Chapter 1) and its adequacy and condition (see Chapter 2). Of central concern to policymakers, however, is the level of funding research-performing institutions need for both the construction of S&E research facilities and the repair/renovation of S&E research space. Institutions reported that 13 percent of all S&E research space required major repair/renovation and another 4 percent required replacement in 1994. (See Table 2-2, page 2-5.) This does not mean, however, that institutions have the resources to repair/renovate or replace this space.

This chapter provides insights into the amount of funding that is required for current S&E research space needs that cannot be funded with available resources.

The Survey Question

To address the issue of need, the 1994 survey introduced a new item. In order to obtain an estimate of needed funding for capital projects involving S&E research space, institutions were asked to report whether an approved institutional plan existed that included "any deferred space that requires repair/renovation or new construction." Four criteria were used to define deferred space:

- The space must be necessary to meet the critical needs of current faculty or programs;
- Construction must not be scheduled to begin during fiscal years 1994–1995;
- Construction must not currently have funding; and
- The space must not be for developing new programs or expanding the number of faculty.

Using these standards, respondents were asked to estimate for each S&E field the construction costs and the repair/renovation costs of such projects. (See Item 9 of the survey in Appendix C.)

Data Considerations

Beyond issues of sheer survival, the concept of "need" becomes subject to interpretation from different perspectives. The specific criteria used in the 1994 facilities survey were developed to place a defined boundary around the concept of "need." The criteria cannot preclude the possibility that, by some different definition, additional facilities needs might be identified. For example, estimates of deferred construction and repair/renovation needs in the 1988 and 1990 surveys, derived from several survey items, were considerably higher than the 1994 estimate of $5,744 million. On the other hand, use of the present multiple criteria cannot guarantee that all facilities included in approved plans reflect the same level of construction urgency.

The chief benefit of using these multiple, explicit criteria is that they provide *a specific description* of the facilities needs to be included and excluded from consideration, thus allowing meaningful interpretation of individual data points and the development of trends across future surveys.

For this survey, 40 percent of all institutions indicated that they had an approved institutional plan that included deferred space; 60 percent had no such approved plans. Thus, the deferred space needs reported here directly reflect the needs of these 40 percent of institutions who met the definitional criteria. No attempt is made to estimate "facilities needs" under some other, less formal definition. (See Appendix A, *Technical Notes*, for further discussion of estimates.)

Findings

What Was the Extent of Needed, but Deferred, Capital Projects?

A total of 40 percent of all research-performing universities and colleges had an approved institutional plan that included either construction or repair/renovation projects that were deferred and unfunded. (See Table 5-1 on the following page.) The top 100 institutions were most likely to have had such a plan (60 percent) and the nondoctorate-granting institutions were least likely (26 percent).

Table 5-1. Percentage of institutions with needed but deferred capital projects to construct and or to repair renovate science and engineering (S&E) research facilities by institution type and project type: 1994

Institution type	Need for capital projects to either construct or repair/ renovate S&E research facilities	Need for capital projects to construct new S&E research facilities	Need for capital projects to repair/ renovate existing S&E research facilities
Total	40	26	33
Doctorate-granting	51	35	43
Top 100 in research expenditures	60	52	48
Other	47	28	41
Nondoctorate-granting	26	15	20

SOURCE: National Science Foundation SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Universities and colleges were, in general, more likely to have had plans for deferred repair/renovation projects than for the deferred construction of facilities. The top 100 institutions, however, were as likely to have had plans for construction projects as for repair/renovation. Fifty-two percent of the top 100 institutions that responded to this item indicated deferred construction projects in their plans; 48 percent of that same group had deferred projects for repair/ renovation of S&E facilities.

What Was the Estimated Cost of Deferred Capital Projects?

Deferred construction costs were estimated at $4,047 million across all research-performing institutions that responded to this item, while deferred repair/ renovation costs totaled $1,697 million. (See Table 5-2 on the following page.)

Table 5-2. Expenditures for deferred capital projects to construct or repair/renovate science and engineering (S&E) research facilities by institution type and type of project: 1994
[Dollars in millions]

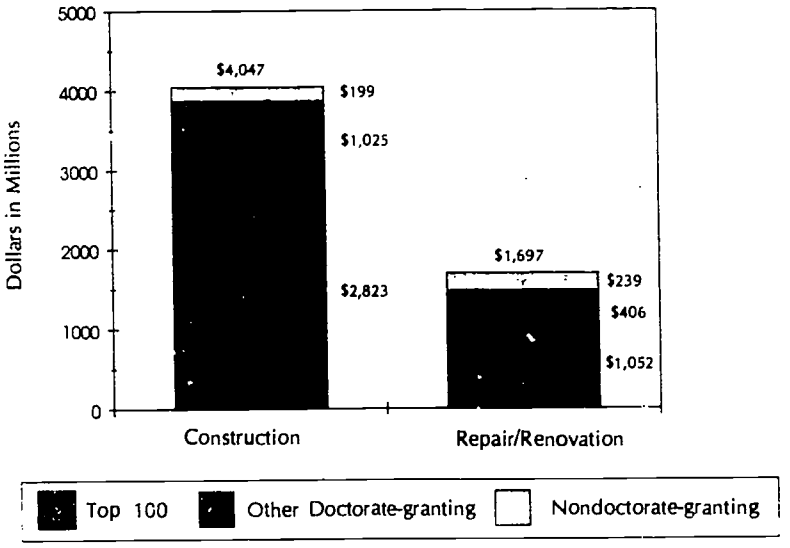
Institution type	To construct S&E research facilities	To repair/renovate S&E research facilities
Total	4,047	1,697
Doctorate-granting	3,848	1,458
Top 100 in research expenditures	2,823	1,052
Other	1,025	406
Nondoctorate-granting	199	239

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

The top 100 institutions in research expenditures that responded to this item accounted for over two-thirds of the estimated construction costs, $2,823 million, and 61 percent of repair/renovation costs, $1,052 million.

In nondoctorate-granting institutions with an approved institutional plan, $199 million were estimated for deferred construction and $239 million for deferred repair/renovation (Figure 5-1).

Figure 5-1. Unfunded science and engineering capital needs total $5,744 million
[Dollars in millions]



SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

All of these estimates of deferred need must be interpreted cautiously. These figures are based on universities and colleges that reported approved institutional plans that included deferred space for either construction or repair/renovation that was unfunded. As a result, these dollar figures do not represent total need for S&E facility improvements; at best, they provide a lower limit estimate of unmet need.

How Were Deferred Capital Projects Distributed across S&E Fields?

Deferred and unfunded need existed in all S&E fields. For research-performing universities and colleges with approved institutional plans for S&E research space, unfunded need for construction projects in the agricultural sciences was indicated more frequently than in any other field. Twenty-one percent, or slightly over one-fifth, of all responding institutions with research space in the agricultural sciences reported unfunded need for new facilities in this field. Four other fields were mentioned by at least 10 percent of the responding group. The fields were engineering, named by 18 percent of these institutions; the physical sciences and the medical sciences in medical schools, each named by 16 percent; and the biological sciences outside of medical schools, named by 14 percent of these institutions with space in this field. (See Table 5-3 on the following page.)

Table 5-3. Percentage of institutions with deferred capital projects to construct and/or to repair/renovate science and engineering (S&E) research facilities by field and project type: 1994

Field	Need for capital projects to construct S&E research facilities	Need for capital projects to repair/ renovate S&E research facilities
Engineering	18	22
Physical sciences	16	25
Environmental sciences	9	13
Mathematics	3	11
Computer sciences	4	9
Agricultural sciences	21	21
Biological sciences—other	14	22
Biological sciences—medical school	5	9
Medical sciences—other	9	10
Medical sciences—medical school	16	14
Psychology	4	8
Social sciences	5	8

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Institutions most frequently indicated the physical sciences as the S&E field with unfunded need for repair/renovation of their research facilities. One-fourth of responding universities and colleges indicated that their institutional plans included unfunded repair/renovation projects in this field. Over 20 percent of the responding research-performing universities and colleges reported unfunded need for repair/renovation in the following three fields: engineering (22 percent); the biological sciences outside of medical schools (22 percent); and agricultural sciences (21 percent).

Chapter 6

Historically Black Colleges and Universities

Highlights . . .

- The panel of 29 Historically Black Colleges and Universities (HBCUs) that has been sampled since 1988 contained 6.1 million net assignable square feet (NASF) of science and engineering (S&E) space; 29 percent of this space was designated for research.
- Expenditures for S&E research space construction in the panel of 29 HBCUs sampled since 1988 declined from $83.2 million (constant dollars) in fiscal years 1986–1987 to $8.6 million in fiscal years 1992–1993.
- The Federal government has consistently provided HBCUs with the majority of their funds for both construction and repair/renovation projects.

Context

HBCUs have played an important role in the education of black students at all higher education levels for over 100 years. These universities and colleges consist of both public and private institutions as well as two-year, four-year, and professional schools. In 1991, approximately 269,000 students attended the 105 institutions of higher education considered HBCUs by the U.S. Department of Education.

Although HBCUs have considerably less S&E research space than other research-performing institutions, they are an important source of science and engineering degrees for black students who attend college. A recent study of science and engineering doctorates revealed that almost 30 percent of black science and engineering doctorate degree recipients between 1985 and 1990 received their bachelors' degrees from HBCUs. (See Appendix D, *Undergraduate Origins of Recent Science and Engineering Doctorate Recipients*, 1992.)

This chapter profiles the state of S&E research facilities at the research-performing HBCUs. It examines all of the topics covered in previous chapters, including the amount of S&E space, its adequacy and condition, construction and repair/renovation activities, funding sources for these projects, and the need for additional or renovated space.

The Survey Question

The profile of HBCUs in this chapter is based on all of the survey questions considered in previous chapters.

Data Considerations

The National Advisory Committee on Black Higher Education and Black Colleges and Universities identifies 107 HBCUs.[1] Of this group, 29 reported separately budgeted research expenditures in 1988, the year in which the first full-scale facilities survey was conducted by the National Science Foundation (NSF). All of these institutions were included in the 1988 and subsequent samples. In 1992, NSF identified an additional 41 HBCUs that had separately budgeted research and development (R&D) expenditures. In both 1992 and 1994, the survey

[1] The National Center for Educational Statistics (NCES) and NSF both used the list created by the White House Initiative on Historically Black Colleges and Universities to identify HBCUs. The discrepancy in the numbers of HBCUs reported by NCES (105) and NSF (107) results from differences in the way multi-campus institutions were counted. NSF counted each campus of multi-campus institutions as a separate unit; NCES considered multi-campus institutions as single entities.

sample included the original panel of 29 institutions and the additional 41 for a total of 70 research-performing HBCUs. As a result, two sets of estimates for HBCUs can be presented. This chapter presents an overall space estimate for all 70 research-performing HBCUs. All remaining analyses focus on the 29 HBCUs included in the sample since 1988. These institutions are referred to as the panel of 29 HBCUs. (See Volume 2, *Statistical Tables*, for more detailed information regarding all 70 HBCUs.)

Findings

How Much Research Space did HBCUs Have?

In 1994, the 70 research-performing HBCUs contained 7.9 million NASF of S&E space; 28 percent of this S&E space, 2.2 million NASF, was designated as research space (Table 6-1).

In 1994, the panel of 29 HBCUs contained 6.1 million NASF of S&E space; 29 percent of this space was designated for research. Eighty percent of all S&E research space in HBCUs was concentrated in the panel of 29 HBCUs. Thus, the panel of 29 universities and colleges that has participated since the first survey represented the bulk of all research space in HBCUs. To facilitate analyses of trends in HBCUs' research space and funding, the remainder of this chapter focuses on this panel of 29 institutions.

Table 6-1. Trends in the amount of space assigned to science and engineering (S&E) fields at Historically Black Colleges and Universities: 1988–1994
(Net assignable square feet in millions)

Index	1988	1990	1992	1994[1]	1994[2]
Total S&E space	6.1	6.2	6.6	6.1	7.9
S&E research space	1.1	1.4	1.8	1.8	2.2
S&E research space as a percentage of total space	18	23	27	29	28

[1] Data for this item and 1988, 1990, and 1992 are based on the 29 HBCUs included in the survey consistently since 1988.

[2] Data for this item are based on the 70 research performing HBCUs as identified by NSF.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

The total amount of S&E space in the panel of 29 HBCUs decreased somewhat between 1992 and 1994, from 6.6 million to 6.1 million NASF. S&E research space in the panel of 29 HBCUs was basically unchanged at 1.8 million NASF in 1992 and 1994; thus, the decline occurred primarily in non-research space. S&E research space as a percentage of total S&E space has steadily increased among the panel of 29 HBCUs since 1988, when the amount was 18 percent.

In 1994, two fields occupied half of all the research space in the panel of 29 HBCUs: the agricultural sciences and the biological sciences. (These two fields accounted for 37 percent of the research space in the total 565 research-performing institutions in this study.) (See Table 1-6, page 1-9.) The amount of engineering research space was also relatively high in the 29 HBCUs, occupying 18 percent of all research space. The physical sciences and the medical sciences each comprised 12 percent of the total (Table 6-2).

Table 6-2. Trends in the distribution of science and engineering research space at Historically Black Colleges and Universities by field: 1988–1994

Field	1988	1990	1992	1994[1]
	[Net assignable square feet in thousands]			
Total research space	1,112	1,440	1,782	1,759
	[Percentage of total]			
Engineering	14	12	16	18
Physical sciences	16	13	13	12
Environmental sciences	1	2	2	2
Mathematics	1	2	2	1
Computer sciences	4	2	2	2
Agricultural sciences	23	30	23	27
Biological sciences	21	20	21	23
Medical sciences	16	14	16	12
Psychology	1	1	1	1
Social sciences	3	3	3	2

[1] Data for this item and 1988, 1990, and 1992 are based on the 29 HBCUs included in the survey consistently since 1988.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

What Was the Condition of Research Space in HBCUs?

In 1994, 31 percent of the S&E research space in the panel of 29 HBCUs was rated as "suitable for the most scientifically sophisticated research;" this represented a slight drop from the 34 percent of space rated this way in 1992. Nine percent of all space needed major repair/renovation or replacement (Table 6-3).

Table 6-3. Assessment of quality/condition of science and engineering (S&E) research facilities at Historically Black Colleges and Universities: 1988–1994
[Percentage of research space]

Condition of S&E research facilities	1988	1990	1992	1994[1]
Total	100	100	100	100
Suitable for most highly developed and scientifically sophisticated research	36	31	34	31
Effective for most purposes	39	45	41	39
Requiring limited repair/renovation[2]	18	18	17	21
Requiring major repair/renovation[2]	7	7	8	9

[1] Data for this item and 1988, 1990, and 1992 are based on the 29 HBCUs included in the survey consistently since 1988.

[2] Includes both "requires major repair or renovation" and "requires replacement."

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

What Was the Extent of Capital Projects at HBCUs?

Since the inception of the survey, the panel of 29 HBCUs experienced large decreases in expenditures for research space construction. In constant dollars, there was a decline of almost $75 million in construction expenditures between fiscal years 1986–1987 and fiscal years 1992–1993. In fiscal years 1986–1987, the 29 HBCUs spent $83.2 million (constant dollars); in fiscal years 1992–1993, these institutions spent $8.6 million on construction projects. (See Table 6-4 on the following page.)

Table 6-4. Trends in construction of science and engineering (S&E) research facilities at Historically Black Colleges and Universities: 1986–1995

Total expenditures for S&E research space construction	1986–1987	1988–1989	1990–1991	1992–1993	1994–1995[1] (Planned)
Current dollars in millions	71.8	55.1	22.5	8.6	24.4
Constant 1993 dollars in millions[2]	83.2	59.5	23.5	8.6	24.4

[1] Data for this item and 1988, 1990, and 1992 are based on the 29 HBCUs included in the survey consistently since 1988.

[2] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Repair/renovation expenditures also dropped, but not quite as dramatically as construction expenditures. In fiscal years 1986–1987, the panel of 29 HBCUs spent $16.3 million in constant dollars; in fiscal years 1992–1993, repair/renovation to S&E research space at these institutions totaled $8.7 million. Repair/renovation projects that were planned for fiscal years 1994–1995 totaled $13.9 million (Table 6-5).

Table 6-5. Trends in repair renovation of science and engineering (S&E) research facilities at Historically Black Colleges and Universities: 1986–1995

Total expenditures for S&E research space repair/renovation	1986–1987	1988–1989	1990–1991	1992–1993	1994–1995 (Planned)
Current dollars in millions	14.1	16.6	11.6	8.7	13.9
Constant 1993 dollars in millions[2]	16.3	17.9	12.1	8.7	13.9

[1] Data for this item and 1988, 1990, and 1992 are based on the 29 HBCUs included in the survey consistently since 1988.

[2] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

For both types of activities, construction and repair/renovation, the panel of 29 HBCUs indicated that they would spend more during fiscal years 1994–1995 than they did in fiscal years 1990–1991 and fiscal years 1992–1993.

What Was the Source of Funding for Capital Projects?

The Federal government provided the majority of funds for both construction and repair/renovation projects to the panel of 29 HBCUs. For fiscal years 1992–1993, the Federal government contributed $6.6 million, or 77 percent of all S&E research construction funds (Table 6-6), and $5 million, or 55 percent of all S&E research repair/renovation funds. (See Table 6-7 on the following page.)

Table 6-6. Trends in the sources of funding for capital projects to construct science and engineering research facilities at Historically Black Colleges and Universities: 1986–1993
[Constant 1993 dollars in millions][1]

Funding sources	1986–1987	1988–1989	1990–1991	1992–1993[2]
Total	83.2	59.5	23.5	8.6
Federal Government	37.9	37.8	12.6	6.6
State/local government	29.9	12.4	6.6	2.0
Private donations	12.9	8.3	0	0
Institutional funds	2.7	1.0	4.4	0
Debt financing	0	0	0	0
Tax-exempt bonds	0	0	0	0
Other debt	0	0	0	0
Other sources	0	0	0	0

[1] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

[2] Data for this item and 1988, 1990, and 1992 are based on the 29 HBCUs included in the survey consistently since 1988.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Table 6-7. Trends in the sources of funding for capital projects to repair/renovate science and engineering research facilities at Historically Black Colleges and Universities: 1986–1993
[Constant 1993 dollars in millions][1]

Funding sources	1986–1987	1988–1989	1990–1991	1992–1993[2]
Total	16.3	17.1	12.1	9.0
Federal Government	10.1	13.9	3.6	5.0
State/local government	5.7	0.9	8.3	2.1
Private donations	0.6	2.2	0.1	1.7
Institutional funds	0	0.1	0.1	0.1
Debt financing	0	0	0	0
Tax-exempt bonds	0	0	0	0
Other debt	0	0	0	0
Other sources	0	0	0	0

[1] Current dollars have been adjusted to 1993 constant dollars using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction.

[2] Data for this item and 1988, 1990, and 1992 are based on the 29 HBCUs included in the survey consistently since 1988.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Relatively speaking, the Federal government provided a much larger share of total capital project funds to HBCUs than to either public or private higher education institutions in general. The Federal government provided less than 20 percent of all construction funds and less than 10 percent of all repair/renovation funds to research-performing institutions overall. (See Tables 4-3 through 4-6.)

In fiscal years 1992–1993, state and local governments were the only other source of funding for S&E research construction projects for the panel of 29 HBCUs and were the second highest contributors to repair/renovation funds.

What Was the Extent of Unfunded Capital Projects?

Thirty-six percent, or slightly over a third of the panel of 29 HBCUs, reported deferred and unfunded S&E research construction projects that were included in an approved institutional plan. These projects totaled $93.8 million. It should be noted that three HBCUs had particularly large S&E research construction projects included in their institutional plans.

Eighteen percent of the panel of 29 HBCUs indicated the presence of approved plans with unfunded and deferred repair/renovation projects for S&E research space. These projects totaled $9.2 million (Table 6-8).

The estimated cost of unfunded and deferred capital projects, both construction and repair/renovation, represents a conservative estimate of the total need for S&E research capital projects. The restrictive nature of the survey question limited the number of institutions that could respond.[2]

Table 6-8. Historically Black Colleges and Universities with need for capital projects to construct or repair/renovate science and engineering research facilities: 1994[1]

Total need expenditures	*Construction*	*Repair/renovation*
Dollars in millions	93.8	9.2
Percentage with need	36	18

[1] Data for this item and 1988, 1990, and 1992 are based on the 29 HBCUs included in the survey consistently since 1988.

SOURCE: National Science Foundation/SRS. 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

[2] To obtain an estimate of needed funding for S&E research space, institutions were asked to report whether an approved institutional plan existed that included "any deferred space that requires repair/renovation or new construction." Four criteria were used to define deferred space: (1) the space must be necessary to meet the critical needs of current faculty or programs; (2) construction must not be scheduled to begin during fiscal years 1994–1995; (3) construction must not currently have funding; and (4) the space must not be for developing new programs or expanding the number of faculty.

Chapter 7

Predominantly Undergraduate Institutions

Highlights . . .

- Predominantly undergraduate institutions, defined in this chapter as comprehensive universities and liberal arts colleges with research and development (R&D) expenditures of $50,000 or more, had approximately 25 million net assignable square feet (NASF) of space in the science and engineering (S&E) disciplines. Seventeen percent of this space, 4.1 million NASF, was devoted to research.
- Predominantly undergraduate institutions spent $65 million to construct S&E research space in fiscal years 1992–1993, and over $27 million to renovate their S&E research space during this same period. The overwhelming majority of construction, 91 percent, took place at comprehensive universities.
- Comprehensive universities financed capital projects primarily through state funds; liberal arts colleges depended mostly on private and Federal funds.

Context

Previous chapters have examined differences in S&E research facilities across two types of institutions: doctorate-granting and nondoctorate-granting. In this chapter, a subset of nondoctorate-granting institutions is examined more closely–predominantly undergraduate institutions. These predominantly undergraduate institutions exclude the HBCUs which were dealt with in the previous chapter and consist of the remaining nondoctorate-granting institutions, that is the comprehensive universities and liberal arts colleges.

Predominantly undergraduate institutions have considerably less S&E research space than doctorate-granting universities. However, their contributions to the scientific enterprise are typically noted through their role in training future scientists and engineers. A National Science Foundation (NSF) study, *Undergraduate Origins of Recent Science and Engineering Doctorate Recipients*, reports that 34 percent of the individuals who were awarded science and engineering doctorates between 1985 and 1990 received their undergraduate degrees from either comprehensive universities (20 percent) or liberal arts colleges (14 percent). (See Appendix D, *References*.)

In April 1994, the Committee on Science, Space, and Technology of the House of Representatives expressed concern "that NSF's biennial survey of academic research facilities needs . . . has not focused adequately on the needs of undergraduate institutions."[1] Although the 1994 survey and sample could not be adjusted to address this concern, its results can provide insight into several issues regarding the S&E research facilities of a select group of undergraduate institutions. These findings are presented in this chapter.

The Survey Question

The profile of predominantly undergraduate institutions presented in this chapter is based on all of the survey questions considered in previous chapters.

Data Considerations

Predominantly undergraduate institutions contribute to research primarily through educating students and training them to become researchers. Although considerable research activity does occur at these institutions, direct research is not their primary contribution to the scientific enterprise. The current NSF

[1] U.S. Congress, House, *National Science Foundation Authorization Act of 1994*, 103rd Cong., 2d sess., Report 103-475.

facilities survey, designed to collect information on the size, condition, and needs of the nation's research-performing universities and colleges, collects data from a sample of higher education institutions that report R&D expenditures of at least $50,000 in S&E fields.[2] Many universities and colleges that focus on undergraduate education do not report such expenditures and therefore are not included in this survey; yet, these institutions do teach large numbers of students and award degrees in S&E fields to individuals who conduct S&E research. Results from analyses reported in this chapter, however, cannot be generalized to undergraduate institutions that did not report R&D expenditures of at least $50,000.

The Carnegie Classification of Institutions of Higher Education is used to distinguish between two different groups of predominantly undergraduate institutions: comprehensive universities, colleges that offer a liberal arts program along with other programs such as engineering, business administration, or nursing; and liberal arts colleges, institutions that primarily award bachelor's degrees and that grant more than half their degrees in the liberal arts.[3] The NSF facilities sample includes 54 comprehensive universities that represent 136 institutions, and 26 liberal arts colleges that represent 52 such institutions. The 5 tables presented in this chapter also include results from the 54 nondoctorate-granting HBCUs,[4] so that the resulting totals of all nondoctorates match the data presented in all previous totals for nondoctorates in Chapters 1 through 5. Discussion, however, is limited to the predominantly undergraduate institutions. (See Chapter 6 for more information on and discussion of HBCUs.)

[2] The sample for the facilities study is based upon information collected in NSF's *Survey of Scientific and Engineering Expenditures at Universities and Colleges*. The facilities sample can be generalized to academic institutions that report spending at least $50,000 in separately budgeted research and development funds. See Appendix B for a list of individual institutions within the sample.

[3] NSF uses the term "predominantly undergraduate institution" to refer to schools that (1) grant baccalaureate degrees in NSF-supported fields or provide instructional programs for students pursuing such degrees with institutional transfers; (2) have an undergraduate enrollment exceeding that at the graduate level; and (3) have awarded no more than 20 Ph.D.s or D.Sci in all NSF-supported disciplines during the past two previous academic years. All institutions identified from the NSF facilities survey meet these criteria. However, since the NSF sampling universe includes only those institutions with separately budgeted R&D expenditures, the more typical usage of this term includes a broader group of institutions.

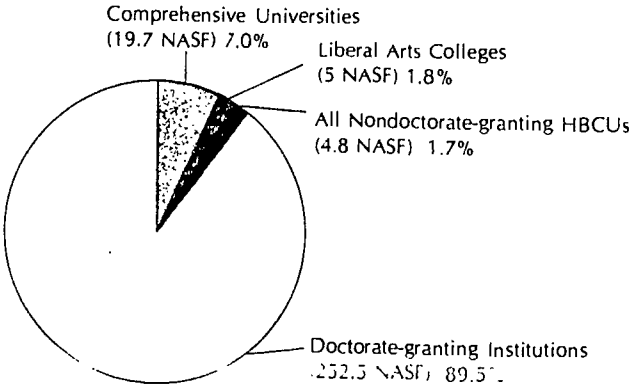
[4] Results reported in the previous chapter, Chapter 6, are limited to the panel of 29 HBCUs originally sampled in 1988. Findings presented in this chapter include the expanded HBCU sample of 70. Therefore, HBCU data presented in tables in this chapter cannot be compared to those reported in Chapter 6.

Findings

How Much Research Space Did Predominantly Undergraduate Institutions Have?

The amount of S&E research space at predominantly undergraduate institutions (that is, comprehensive universities and liberal arts colleges) was a relatively small portion of the total reported by all institutions included in the study. Comprehensive universities had 7 percent of the total S&E research space, and liberal arts colleges had a modest 1.8 percent. The balance of S&E research space (91.2 percent) was in the other types of institutions (Figure 7-1).

Figure 7-1. Predominantly undergraduate institutions have relatively little science and engineering research spaces.
[Net assignable square feet (NASF) in millions]



SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

All nondoctorate institutions held a total of 29.5 million NASF of S&E space. Predominantly undergraduate institutions had about 25 million NASF of that space (Table 7-1). Of the predominantly undergraduate institutions, comprehensive universities contained over 19 million NASF of S&E space, or almost 80 percent of the total S&E space in predominantly undergraduate institutions.

Table 7-1. Science and engineering (S&E) research space at predominantly undergraduate institutions: 1994

Predominantly undergraduate institutions	Total S&E space	Research space	
	(NASF in millions)	In S&E fields (NASF in millions)	Percentage of total S&E space
Total: All nondoctorates	29.5	5.4	18.4
Nondoctorate HBCUs[1]	4.8	1.3	27.0
Predominantly undergraduate	24.7	4.1	16.6
Comprehensive universities	19.7	3.1	15.7
Liberal arts colleges	5.0	1.0	20.0

[1] All nondoctorate HBCUs are included, not just those from the panel of 29. Therefore, results cannot be compared to those in Chapter 6.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Predominantly undergraduate institutions dedicated 4.1 million NASF to S&E research, about 17 percent of their total S&E space. Of that 4.1 million NASF, comprehensive universities dedicated 3.1 million NASF to S&E research, and liberal arts colleges dedicated 1 million NASF to S&E research.

What Was the Condition of the Research Space at Predominantly Undergraduate Institutions?

Almost half of the S&E research space in both comprehensive universities (44 percent) and liberal arts colleges (46 percent) was rated as "effective for most uses," though not suitable for the most sophisticated research in the field. (See Table 7-2 on the following page.) Combined with the amount of space rated as suitable for the most sophisticated research, the predominantly undergraduate institutions had a total of 54 percent for comprehensive universities and 63 percent for liberal arts colleges of their space in the top two categories. These amounts are comparable to the doctorate-granting institutions which rated 59 percent of their space in these two categories. (See Table 2-2, page 2-5.)

Table 7-2. Assessment by predominantly undergraduate institutions of quality condition of science and engineering research facilities: 1994
(Percentage of research space)

Predominantly undergraduate insitutions	Suitable for use in most scientifically sophisticated research	Effective for most uses, but not most sophisticated	Needs limited repair/ renovation	Requires major repair/ renovation	Requires replacement	Total
Total: All nondoctorates	16	42	26	14	2	100
Nondoctorate HBCUs[1]	29	30	23	18	1	100
Predominantly undergraduate	12	46	28	12	3	100
Comprehensive universities	10	44	28	13	3	100
Liberal arts colleges	17	46	25	9	2	100

[1] All nondoctorate HBCUs are included, not just those from the panel of 29. Therefore, results cannot be compared to those in Chapter6.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

A somewhat higher percentage of the S&E research space was rated as suitable for sophisticated research in liberal arts colleges (17 percent), than in comprehensive universities (10 percent).

In both types of predominantly undergraduate institutions, 3 percent or less of the S&E research space was rated in need of replacement. Overall, in all research-performing institutions, 4 percent of the S&E research space was evaluated as needing replacement. (See Table 2-2, page 2-5.) In predominantly undergraduate institutions, 12 percent of all S&E research space was rated as needing major repair/renovation.

How Extensive Was Construction and Repair/Renovation Activity at Predominantly Undergraduate Institutions?

All nondoctorate institutions spent $92.3 million to construct S&E research space and $34.5 million to repair/renovate S&E research space. Combined, the predominantly undergraduate institutions spent $65.2 million to construct S&E research space in fiscal years 1992–1993 and $27.2 million to repair/renovate their S&E research space (Table 7-3). Comprehensive universities spent over ten times as much on construction projects and almost one and one-half times as much on repair/renovation projects as did liberal arts colleges. It should be noted, however, that comprehensive universities are generally larger than liberal arts colleges and that more comprehensive universities are actively engaged in research than liberal arts colleges.

Table 7-3. Capital project costs for science and engineering research space at preduminantly undergraduate institutions: 1992–1993
[Dollars in millions]

Predominantly undergraduate institutions	New construction costs	Repair/ renovation costs	Total capital projects
Total: All nondoctorates	92.3	34.5	126.8
Nondoctorate HBCUs[1]	27.1	7.2	34.3
Predominantly undergraduate	65.2	27.2	92.4
Comprehensive universities	60.2	16.5	76.7
Liberal arts colleges	5.0	10.7	15.8

[1] All nondoctorate HBCUs are included, not just those from the panel of 29. Therefore, results cannot be compared to those in Chapter 6.

SOURCE: National Science Foundation/SRS. 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

In fiscal years 1992–1993, the amount spent for S&E research construction projects at predominantly undergraduate institutions represented about 2 percent of all money spent for S&E research construction at all research-performing universities and colleges. (See Table 3-1, page 3-4.) Repair/renovation to S&E research facilities at predominantly undergraduate institutions represented approximately 3 percent of all repair/renovation dollars in fiscal years 1992–1993. (See Table 3-3, page 3-5.)

How Did Predominantly Undergraduate Institutions Fund Capital Projects?

Comprehensive universities relied upon vastly different sources than liberal arts colleges to fund capital projects. During fiscal years 1992–1993, 80 percent of all capital projects at comprehensive institutions were funded through state revenues, while liberal arts colleges received no funding from states (Table 7-4).

Table 7-4 Sources of funding for capital projects of science and engineering research space at predominantly undergraduate institutions: 1992–1993 (Percentages of total funding)[1]

Funding sources	Comprehensive universities	Liberal arts colleges	All predominantly undergraduate insitutions	Nondoctorate HBCUs [2]	All nondoctorates
Total	100	100	100	100	100
Federal Government	7	26	13	20	13
State/local government	80	0	67	70	67
Private donations	7	26	9	4	9
Institutional funds	1	36	5	2	5
Tax-exempt bonds	5	11	4	0	4
Other debt	0	0	0	0	0
Other sources	0	0	1	5	1

[1] Percentages may not add to 100 due to rounding.

[2] All nondoctorate HBCUs are included, not just those from the panel of 29. Therefore, results cannot be compared to those in Chapter 6.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

The 80 percent represented $60 million. This reflects the fact that comprehensive universities are more likely to be public institutions than are liberal arts colleges. Liberal arts colleges relied about equally on Federal and private funds, each accounting for slightly over one-quarter of the capital funds or $4.1 million each. Institutional contribution (institutional funds, tax-exempt bonds, and other debt) accounted for 47 percent or 6.9 million of the capital funds at liberal arts colleges. (See Table 7-5 on the following page.)

Table 7-5. Sources of funding for capital projects of science and engineering research space at predominantly undergraduate institutions: 1992–1993
(Dollars in millions)

Funding sources	Comprehensive universities	Liberal arts colleges	All predominantly undergraduate insitutions	Nondoctorate HBCUs[1]	All nondoctorates
Total	74.6	15.75	90.36	34.3	124.67
Federal Government	3.0	4.1	9.1	6.8	16.0
State/local government	60.0	0.0	60.0	24.0	84.0
Private donations	5.3	4.1	9.4	1.4	10.7
Institutional funds	0.6	5.7	6.3	0.6	6.8
Tax-exempt bonds	3.7	1.8	5.5	0	5.5
Other debt	0	0	0	0	0
Other sources	0.007	0.05	0.067	1.6	1.6

[1] All nondoctorate HBCUs are included, not just those from the panel of 29. Therefore, results cannot be compared to those in Chapter 6.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

What Was the Extent of Unfunded Capital Projects?

Of all research-performing institutions in this study, 40 percent had an approved institutional plan that included deferred and unfunded construction or repair/renovation projects for S&E research space. Based on their plans, about 10 percent of the comprehensive institutions and 23 percent of the liberal arts colleges indicated unfunded and deferred construction projects for S&E research space. Twenty percent of the comprehensive universities and 29 percent of the liberal arts colleges reported unfunded and deferred repair/renovation. The deferred needs of the institutions who did not respond to this item remain unknown.

Although the liberal arts colleges that were engaged in funded S&E research had considerably less S&E research space than did comprehensive institutions, deferred construction costs at liberal arts colleges were notably larger. In the liberal arts colleges, deferred costs for construction were $97.1 million; in comprehensive universities, these costs were $26.4 million. However, the comprehensive universities reported much larger unfunded needs in deferred repair/renovation than did the liberal arts colleges, $178.3 million and $54.8 million respectively. Combined, the deferred capital projects, both construction and repair/renovation, at predominantly undergraduate institutions totaled $356.6 million (Table 7-6).

Table 7-6. Deferred capital project costs of science and engineering research space at predominantly undergraduate institutions: 1992–1993
[Dollars in millions]

Predominantly undergraduate institutions	Deferred construction costs	Deferred repair/ renovation costs	Total capital projects
Total: All nondoctorates	198.7	238.7	437.4
Nondoctorate HBCUs[1]	75.2	5.6	80.8
Predominantly undergraduate	123.5	233.0	356.6
Comprehensive universities	26.4	178.3	204.7
Liberal arts colleges	97.1	54.8	151.9

[1] All nondoctorate HBCUs are included, not just those from the panel of 29. Therefore, results cannot be compared to those in Chapter 6.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Appendix A

Technical Notes

Technical Notes

This appendix discusses the study methodology as well as various other technical aspects that the reader should consider when interpreting the data presented in this report. In addition to the current 1994 survey, the discussion includes the original 1988 survey, the 1990 survey, and the 1992 survey. The following topics are covered:

- Universe and sample
- The surveys
- Data collection and response rates
- Item nonresponse
- Weighting
- Reliability of survey estimates
- Data considerations, definitions, and limitations

Universe and Sample

1988 Survey

The 1988 survey was designed to provide estimates for all research-performing academic institutions, as defined in the National Science Foundation's (NSF) Fiscal Year (FY) 1983 Survey of Scientific and Engineering Expenditures at Universities and Colleges. The universe datafile for the 1983 expenditures survey included *all* universities and colleges that offered a master's or doctorate degree in science and engineering (S&E), all others that reported separately budgeted S&E research and development (R&D) expenditures of $50,000 or more, and all Historically Black Colleges and Universities (HBCUs) that reported any R&D expenditures. This datafile represented the most recent available universe survey of R&D expenditures at academic institutions. The datafile contained a total of 566 institutions.

All HBCUs in the frame were included in the sample with certainty (N = 30), and a stratified probability sample of 223 institutions was selected from among the remaining institutions in the frame. These institutions were first stratified by control (public versus private) and highest degree awarded in S&E (doctorate-granting versus nondoctorate-granting). A minimum sample size of 25 was set for

each of the four resulting strata, and the remaining sample size was allocated to strata in proportion to the "size" of each stratum. Stratum size was defined as the square root of the aggregate R&D expenditures in S&E of the institutions in the stratum. Academically administered Federally Funded Research and Development Centers were excluded from this survey. Within strata, institutions were sampled with probability proportionate to size. Again, size was defined as the square root of the institution's fiscal year 1983 R&D expenditures.

Following the selection of an initial sample of 253 institutions, NSF determined that several of the sampled institutions were out of the scope of the survey. Out-of-scope institutions included those in outlying territories, military academies, and three highly specialized institutions considered inappropriate, given the nature of their programs. Elimination of these out-of-scope cases reduced the final sample to 247 institutions, of which 29 were HBCUs and 99 had (or were) medical schools.

Institutions in the sample accounted for more than 75 percent of all academic R&D expenditures in fiscal year 1983 and encompassed at least 70 percent of the spending in each major S&E discipline. The sample represented a weighted national total of 525 institutions. The composition of this survey universe, by type of institution, is shown in Table A-1.

Table A-1. Number of institutions in the survey universe of research-performing universities and colleges: weighted estimates, 1988

Institution type	Total	Non-HBCUs[1]		HBCUs[1]
		Public	Private	
Total	525	296	200	29
Doctorate-granting	293	190	100	3
Top 100 in research expenditures	100	69	31	0
Other	193	121	69	3
Nondoctorate-granting	232	106	100	26

[1] HBCU refers to Historically Black Colleges and Universities.

SOURCE: National Science Foundation/SRS, 1988 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

1990 Survey

The institution sample for the 1990 survey was the same as for the 1988 survey, except for these two changes:

- The sample was updated to reflect recent R&D patterns as shown in NSF's fiscal year 1988 R&D expenditures survey, which collected expenditures data for all institutions in the survey frame for the first time since 1983. School-by-school comparisons of these two databases resulted in the identification of 12 institutions whose 1988 R&D expenditures would have given them substantially higher probabilities of selection than they had using 1983 expenditures. These 12 institutions were made certainty selections for the 1990 survey. Five were already in the sample, having been noncertainty selections in the 1988 study; the other 7 were added to the sample for the 1990 survey.

- One institution from the 1988 sample became out of scope when it distributed its assets among other institutions in the same state system. Therefore, this institution was eliminated from the sample.

The sample changes noted above produced a net increase of 6 institutions, increasing the sample size to 253 in 1990. The universe represented by the sample, however, did not change. The sample design for the 1990 survey is summarized in Table A-2.

1992 Survey

The institution universe and sample for the 1992 survey were the same as for the 1990 survey, except for three changes:

- Shortly after the sample for the 1990 facilities survey was selected, NSF conducted a universe survey of all HBCUs and identified an expanded group of 70 that reported separately budgeted R&D expenditures in S&E disciplines. A sample of 46 of these 70 institutions was selected for the 1992 facilities survey, with probability proportionate to size. Size was measured as the square root of the institution's reported 1989 R&D expenditures (a minimum size measure of $10,000 was used to afford the smallest institutions some possibility of selection).

- The sample was expanded to include all institutions in the top 100 in 1988 R&D expenditures. Only two institutions from this analytically important category were not already in the sample, and they were made certainty selections in 1992.

- To improve the precision of estimates for nondoctorate-granting institutions, an expanded sample of 91 institutions in this category was selected (excluding HBCUs, which were sampled separately). The sample included all (10) public institutions with1988 R&D expenditures of $2 million or more, and all (11) private institutions with 1988 expenditures of $1 million or more. Institutions with R&D expenditures below these cutoffs were sampled with equal selection probabilities.

Of the 91 sampled nondoctorate-granting institutions, 9 were later determined to be out of scope, since they reported in the 1992 facilities survey that they had no S&E research space and also reported in the1988 R&D expenditures survey (which provided the basis for the sampling frame) that they had less than $50,000 in separately budgeted R&D expenditures. The exclusion of these out-of-scope institutions reduced the sample of nondoctorate-granting institutions to 82. The sample design for the 1992 survey is summarized in Table A-2.

1994 Survey

The institution universe and sample for the 1994 survey closely matched the 1992 survey, with the following exceptions:

- The 1991 R&D expenditures survey information was used to generate the top 100 stratum. Three institutions were added to the top 100 list, and three institutions were moved out. The expenditures data also were used to calculate the measure of size for the doctorate-granting institutions. The 1988 expenditures survey data were used to calculate size measures for the nondoctorate-granting institutions, since subsequent surveys did not yield complete information for the nondoctorate-granting institutions.

- Institutions expending less than $50,000 in R&D in S&E fields were removed from the frame prior to sampling. In 1992, they were selected with probability proportionate to size and then excluded after contact.

- FICE codes were updated for 50 institutions.[1]

- Six institutions were misclassified with the 1992 sampling list as nondoctorate-granting, when in fact they did award S&E doctorates. These misclassifications were corrected.

- Random (rather than systematic) draws from the strata were employed.

[1] This is the Federal Interagency Commission on Education number assigned by the Department of Education. Numbers beginning with 66 are for accredited institutions which have not yet receives a FICE number. These are identification numbers for the record file only.

- The HBCUs selected with certainty were redefined to include 28 from the 1990 list,[2] plus all of the new institutions selected with certainty in 1992. This meant that a total of 33 HBCUs was selected with certainty and 12 others were selected with probability proportionate to size.

Of the 314 sampled institutions, 5 nondoctorate-granting institutions were later determined to be out of scope, since they reported no S&E research space. The exclusion of these out-of-scope institutions reduced the sample to 309.

The sample design for the 1994 survey is summarized in Table A-2. (See Appendix B for a list of sampled institutions.)

Table A-2. Number of institutions in the 1990, 1992, and 1994 samples of research performing universities and colleges

Institution type	Non-HBCUs									HBCUs[1]		
	Total			Public			Private					
	1990	1992	1994	1990	1992	1994	1990	1992	1994	1990	1992	1994
Total	224	257	265	138	157	161	86	100	104	29	46	44
Doctorate-granting	173	175	177	115	117	117	58	58	60	3	5	8
Top 100 in research expenditures	98	100	100	67	69	70	31	31	30	0	0	0
Other	75	75	77	48	48	47	27	27	30	3	5	8
Nondoctorate-granting	51	82[2]	88	23	40	44	28	42	44	26	41	36

[1] HBCU refers to Historically Black Colleges and Universities.

[2] Sample initially included nine other institutions that were later classified as out of scope of the study.

SOURCE: National Science Foundation/SRS, 1990, 1992, and 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

The Survey Questionnaire

The 1994 survey questionnaire, which is reproduced in Appendix C, updated information collected during earlier (1988, 1990, and 1992) surveys regarding several topics:

- The total net assignable square feet (NASF) of space in S&E fields, and the NASF used for organized research;
- The total amount of space in all non-science fields, and an overall space total across all academic fields;

[2] One of the 29 HBCUs selected with certainty in 1990 was excluded because it had no current funded R&D at the time the sample was taken.

- The amount of research space that is leased by the institution;
- The condition of research facilities in each S&E field;
- The adequacy of the current amount of research space, by S&E field;
- The project costs, NASF, and sources of funds for major construction and repair/renovation (over $100,000) activities initiated in fiscal years 1992–1993, and planned for fiscal years 1994–1995;
- Expenditures for research facility repair/renovation projects in the $5,000 to $99,999 range;
- Planned expenditures in fiscal years 1994–1995 for construction and repair/renovation of research laboratory animal facilities;
- The status of the institutions relative to the cap on tax-exempt bonds (this item is applicable to private universities and colleges only).

In addition to collecting updated information on the above topics, the 1994 questionnaire also requested information on two topics that had not been addressed in previous surveys. Specifically, in response to questions about unmet construction and repair/renovation needs for S&E research space, the 1994 questionnaire added items asking about the following issues:

- The existence of an approved institutional plan that included deferred space requiring new construction or repair/renovation;
- The number of years included in the plan;
- The estimated costs, by S&E discipline, for needed new construction and repair/renovation that the institution was not scheduled to begin during fiscal years 1994–1995.

In addition, to provide preliminary information on the effects of the requirements of the 1990 Americans with Disabilities Act (ADA), institutions were asked to estimate what portion of their repair/renovation costs from fiscal years 1992–1993 was spent to bring S&E research space into compliance with the ADA. Results from this item are not presented in the 1994 report.

Data Collection and Response Rates

In September 1993, a letter from Frederick M. Bernthal, then Acting Director of NSF, was sent to the president or chancellor of each sampled institution, asking that the institution participate in the study and that a coordinator be named for

the survey. A letter of endorsement of the project signed by the heads of eight higher education associations was also enclosed. After the 2-week deadline for returning the coordinator identification card, telephone followup was conducted with all sampled institutions that had not yet identified a survey coordinator. Survey materials were mailed to the coordinators in mid-October by certified mail, and the return receipt cards served as a control log. For cards that were not returned, receipt of the survey materials was confirmed by telephone in November. The questionnaire and cover letter requested return of the completed survey by December 1, 1993. Nonresponse followup began in mid-December and continued through March 1994.

After the questionnaires were edited, a series of logic and arithmetic checks was run and additional follow-up was conducted to resolve data inconsistencies within the questionnaire or disparities between the 1992 and 1994 survey responses.

After data collection, site visits were conducted, during which NSF and project staff members met with survey respondents to discuss the questionnaire, interpretation and reliability of the data provided, and the survey procedures. The purposes of these visits were to (1) obtain information about the data provided to assist in the analysis of the findings and (2) obtain information that could be used in planning for the 1996 survey.

The overall response rate for the survey was 93 percent. As Table A-3 indicates, response rates were high for all institution categories.

Table A-3. Academic institution response rates, by category of institution: 1994

Institution category	Number of institutions		Response rate
	Sample	Respondents	
Total	309	287	93%
Non-HBCUs[1]:			
Doctorate-granting	177	166	94
Top 100 in research expenditures	100	97	97
Other	77	69	90
Nondoctorate-granting	88	74	84
Public	161	149	93
Private	104	91	88
HBCUs[1]	44	41	93

[1] HBCU refers to Historically Black Colleges and Universities.

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Item Nonresponse

After machine editing of questionnaire responses for completeness, internal consistency, and consistency with data from previous questionnaires, extensive telephone data retrieval was conducted to minimize the amount of missing or otherwise problematic responses to individual questionnaire items. One exception was the item (1a) on total academic space in all disciplines outside S&E fields. This item was difficult for some institutions to answer; and although data retrieval was attempted, the item had an unusually high nonresponse rate (17 percent).

As a result of these followup activities, most of the individual items had very low item nonresponse rates. The item with the highest non-response rate (other than item 1a) was the new item on costs to comply with the 1990 Americans with Disabilities Act (Item 4b). This item had 24 missing values (8 percent). Next highest was the item in 4a asking about the prorated total research space involved in all 1992 and 1993 repair/renovation projects costing $100,000 or more. It had 9 missing values (3 percent). Item 3, the current condition of research space by field, also had 9 missing values (3 percent) for one field: medical sciences, outside of medical school. All other data items had fewer than 9 missing values; that is, all had item response rates over 97 percent.

Missing values were imputed for questionnaire items that were involved in the data analysis. Wherever possible, missing values for items 1, 2, and 3 (amount, condition, and adequacy of existing space) were imputed on the basis of information in the institution's 1992 questionnaire. In questions 4 and 8 (on recent and planned capital projects), most missing values involved either missing costs or missing NASF, but not both. In these cases, the missing data element was imputed from the reported element, using 1992 data on average cost per NASF to estimate one from the other.

Missing values that could not be imputed using the above methods (for example, a missing value on the amount of research space at an institution that had not provided this information in the 1992 survey) were imputed using a "hot deck" approach. This approach involved imputing the missing value from a "donor" institution that did provide the needed information and that was as closely matched as possible to the institution with the missing information in terms of control, type (doctorate-granting or not), and 1988 research expenditures.

Weighting

After data collection, sampling weights were created for use in preparing national estimates from the data. First, within each weight class, a base weight was created for each institution in the sample. The base weight is the inverse of the probability of selecting the institution for the sample. Second, because some institutions in the sample did not respond to the survey, the base weights were adjusted in each weight class to account for this unit nonresponse. Finally, the weights were adjusted again to bring the number of estimated institutions in accordance with the known number of institutions in various categories. For this final "poststratification" adjustment, the institutions were classified by type (top 100 in research expenditures, other doctorate-granting, nondoctorate-granting), control, and HBCU status. The poststratified weights were used to produce the estimates shown in this report. The weighting procedures used were very similar to those used in the 1988, 1990, and 1992 studies.

Reliability of Survey Estimates

The findings presented in this report are based on a sample and are therefore subject to sampling variability. Sampling variability arises because not all institutions are included in the study. If a different sample of institutions had been selected, then the results might have been somewhat different. The standard error of an estimate can be used to measure the extent of sampling variability for that particular estimate.

One of the ways that the standard error can be used is in the construction of confidence intervals. If all possible samples were selected and surveyed under similar conditions, then the intervals of two standard errors below the estimates to two standard errors above the estimates would include the average result of these samples in about 95 percent of the cases. Since only one sample is actually selected and surveyed, the standard error must be estimated from the sample itself. The interval constructed using the estimated standard error from the sample is called a 95 percent confidence interval. Estimated standard errors for selected statistics are shown in Table A-4 on the following two pages.

Table A-4. Standard errors (S.E.) for selected estimates

Statistic	Total		Doctorate granting						Nondoctorate granting		Public		Private	
			Total		Top 100 in research		Other							
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Total research square footage (in thousands):														
1988	112,062	1,864	107,443	2,004	80,627	1,419	26,815	2,019	4,619	437	82,384	1,627	29,678	868
1990	116,327	4,054	111,166	4,092	81,659	1,327	29,508	3,574	5,161	485	86,880	3,538	29,447	1,591
1992	122,015	4,079	117,373	4,185	87,508	0	29,865	4,185	4,642	316	90,815	3,612	31,200	969
1994	127,369	2,885	121,930	2,766	90,974	0	30,956	2,766	5,439	372	91,723	2,163	35,645	1,569
Difference:														
1990 & 1988	4,265	3,586	3,723	3,659	1,032	2,533	2,693	3,659	542	205	4,496	3,026	-231	1,385
1992 & 1990	5,687	6,239	6,207	6,404	5,849	1,327	358	6,412	519	481	3,934	6,246	1,753	1,200
1994 & 1992	5,354	4,996	4,557	5,016	3,466	0	1,091	5,016	797	468	908	4,210	4,445	1,844
Repair / renovation NASF (NASF in thousands)														
1988	838	60	793	58	596	10	197	59	45	8	436	38	402	27
1990	1,010	265	979	264	483	12	496	259	30	15	699	266	311	18
1992	825	40	794	38	632	0	161	38	32	9	449	41	376	15
1994	837	45	803	44	623	0	180	44	34	5	522	41	315	21
Difference:														
1990 & 1988	172	269	186	267	-113	18	299	261	-15	22	263	265	-91	35
1992 & 1990	-185	269	-185	267	150	12	-355	262	2	39	-250	270	65	38
1994 & 1992	12	60	9	58	-9	0	19	58	2	10	73	58	-61	26
Repair / renovation cost (dollars in millions):														
1988	13,431	1,305	12,841	1,345	9,124	304	3,717	1,299	590	90	8,745	1,196	4,685	528
1990	11,449	576	10,993	488	7,781	179	3,212	464	456	229	8,223	473	3,226	237
1992	8,606	657	8,344	624	5,622	0	2,722	624	262	81	5,420	613	3,187	180
1994	9,134	632	8,811	611	6,028	0	2,783	611	323	79	6,011	496	3,123	320
Difference:														
1990 & 1988	-1,982	1,343	-1,848	1,252	-1,343	351	-505	1,276	-134	251	-522	1,233	-1,459	384
1992 & 1990	-2,841	928	-2,649	914	-2,159	179	-490	841	-194	228	-2,804	788	-38	328
1994 & 1992	528	912	467	873	406	0	61	873	61	113	591	789	-64	367

KEY: "NASF" = net assignable square feet

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Table A-4. Standard errors (S.E.) for selected estimates (continued)

Statistic	Total		Doctorate granting						Nondoctorate granting		Public		Private	
			Total		Top 100 in research		Other							
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
New construction costs (dollars in millions):														
1988	2,051	73	1,888	72	1,599	64	288	53	163	19	1,355	36	696	75
1990	2,464	128	2,315	131	1,558	34	757	114	150	56	1,727	108	738	62
1992	2,975	150	2,847	164	2,022	0	826	164	128	99	2,020	110	956	87
1994	2,859	195	2,766	190	2,076	0	690	190	92	42	2,063	157	796	110
Difference														
1990 & 1988	414	140	427	128	-41	83	469	127	-13	60	372	102	42	84
1992 & 1990	511	231	532	249	464	34	69	233	-22	116	293	165	218	115
1994 & 1992	-116	246	-81	251	54	0	-136	251	-36	107	43	192	-160	140
New construction NASF (NASF in thousands):														
1988	9,922	387	8,908	401	7,261	215	1,647	407	1,014	117	7,344	223	2,578	271
1990	10,647	851	9,840	776	6,073	86	3,767	747	807	337	8,115	805	2,532	153
1992	11,817	816	11,022	1,000	6,972	0	4,050	1,000	795	225	8,268	7,857	3,549	230
1994	11,056	974	10,538	902	6,851	0	3,687	902	518	265	8,253	892	2,803	342
Difference:														
1990 & 1988	726	903	932	765	-1,188	242	2,120	881	-207	366	771	772	-46	244
1992 & 1990	1,170	1,508	1,181	1,659	899	86	283	1,633	-12	419	152	1,415	1,017	282
1994 & 1992	-761	1,271	-484	1,347	-121	0	-363	1,347	-277	348	-15	1,170	-746	412

KEY: "NASF" = net assignable square feet

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

Table A-4. Standard errors (S.E.) for selected estimates (continued)

Statistic	Suitable for sophisticated research		Effective for most purposes		Needs limited repair/renovation		Needs major repair/renovation	
	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.	Estimate	S.E.
Amount of research space (NASF in thousands):								
1988	26,793	836	41,114	1,175	26,264	646	17,702	397
1990	30,135	1,239	41,072	1,794	27,047	914	18,073	983
1992	32,723	1,356	42,306	1,846	27,620	1,106	19,370	607
1994	33,743	1,078	41,904	1,017	29,700	1,004	22,021	770

KEY: "NASF" = net assignable square feet

SOURCE: National Science Foundation/SRS, 1994 Survey of Scientific and Engineering Research Facilities at Universities and Colleges

The standard errors for this study were estimated using a replication method called the jackknife repeated replication method. Using this method, the sample is divided into 15 replicates, and estimates are produced for each replicate. The variability among these replicate estimates is then used to estimate the standard error. Because the 1994 sample was independently drawn, the standard error of the difference between 1994 and 1992 estimates was computed under the assumption of independence.

Data Considerations, Definitions, and Limitations

In addition to sampling errors, survey estimates can be adversely affected by nonsampling errors. Errors of this type include those resulting from reporting and processing of data. In this survey, extensive followup with respondents was used to ensure that the data were as accurate as possible. This followup included cross-year review that verified inconsistencies between the current and previous questionnaires.

Research Square Footage

In the 1994 survey, research was defined more broadly than in previous years. However, this change in definition had little effect on how institutions actually reported S&E research space. Like the definition used in previous years, the 1994 definition included all R&D activities that are separately budgeted and accounted for. Unlike the previous definition, the 1994 definition also included departmental research that was not separately budgeted. Conversations with respondents from earlier surveys revealed that some departmental research had been included; thus, the current definition of research reflects what many institutions had been reporting all along.

Previous cycles of this survey used the definition of organized research that is specified in OMB Circular A-21 (the form used for calculation of indirect costs). That definition is as follows: "***Organized research*** *means all research and development activities of an institution that are separately budgeted and accounted for. It includes:* ***(1) Sponsored research*** *means all research and development activities that are sponsored by Federal and non-Federal agencies and organizations . . .* ***(2) University research*** *means all research and development activities that are separately budgeted by the institution under an internal application of institutional funds."*

Institutions' facility recordkeeping systems vary considerably. In general, most of the larger institutions have central computerized facility inventory systems, often based on space surveys conducted specifically for OMB Circular A-21. Many institutions with smaller research programs are not required to calculate square footage for OMB Circular A-21, and do not maintain databases that can provide such information. These institutions had to calculate or estimate square footage information specifically for this study.

Capital Projects Involving Research Facilities

Relatively few institutions maintain information on construction and repair/ renovation projects specific to research facilities. Many capital projects involve both research and nonresearch space. When a project was not exclusively for research, institutions had to estimate the proportion of the project that was related to research facilities. For this purpose, the following guideline was included in the questionnaire instructions: *For multi-purpose facilities, prorate the costs to reflect the proportion of R&D space involved in the projects (e.g., if 20 percent of the space involved is used for organized research, report 20 percent of the total project completion costs).*

Some projects, such as construction or whole-building renovation may take more than one year to complete, and other projects may overlap fiscal years. Projects were allocated to the fiscal year in which actual construction activity began or will begin.

Because institutions use different dollar values to identify "major projects," this survey established a guideline to ensure consistency of reporting. As in previous cycles of the survey, projects with costs of $100,000 or more ***associated with research facilities*** were included. In 1992 and 1994, the surveys also had a separate question about costs of repair/renovation projects in the $5,000 to $99,999 range.

Dollar Amounts: Current Versus Constant Dollars

In this report, capital project dollar amounts are presented in both constant and current dollars but discussed only in terms of 1993 constant dollars. Constant dollars are "inflation adjusted" dollars that adjust for variations in the purchasing power of the dollar over time. Dollar amounts were adjusted using the Bureau of the Census' Composite Fixed-Weighted Price Index for Construction. Unlike a more general index, this construction index closely tracks inflation within the construction industry. This index reflects only changes in prices and is unaffected by changes in the mix of construction projects during any given year.

Previous reports used current, not constant dollars to present trends in capital project expenditures. Comparisons in current dollars tend to overstate increases in spending over time because more current dollars are needed to buy the same products each year. Comparisons in constant dollars provide a more accurate picture of expenditure trends.

The specific adjustments used for each of the fiscal years is shown in Table A-5.

Table A-5. Composite Fixed-Weighted Price Index for Construction inflation adjustments

Fiscal year	*Average Composite Fixed-Weighted Price Index for Construction*[1]
1986–1987	1.159
1988–1989	1.079
1990–1991	1.042
1992–1993	1.000

[1] The index for the second year was used in all calculations that spanned two fiscal years

SOURCE: National Science Foundation/SRS, 1994 Survey of Scient and Engineering Research Facilities at Universities and Colleges

Condition and Adequacy of Research Facilities

A number of respondents stated that reports of the condition and the adequacy of facilities are, by their very nature, subjective. Two persons may make different assessments of the same facility or have different opinions of what is required in order for a facility to be suitable for a particular type of research. Despite the subjectivity involved, these items do capture an overall picture of the current status of facilities. Discussions with respondents at a number of institutions indicated that, for the most part, deans in consultation with department heads reported on the condition and adequacy of facilities. A few institutions indicated that they have detailed condition data in a central database. In those cases, the facilities office was able to respond to these items.

A few institutions indicated that it is conceptually difficult to assess the condition of a research facility without including instrumentation in that assessment. Most respondents, however, indicated that they had no such problem and were able to report on the condition of the "bricks and mortar."

Cost per Square Foot Data

The study did not collect unit cost data for individual construction or repair/renovation projects. It collected only the aggregate research-related costs and the aggregate research space involved in all projects begun during specified periods. These aggregates can be combined into indices of average cost per square foot, which are useful in tracking broad cost trends over time. However, they are of little practical value as guidelines for project planning. By all accounts, unit costs for both construction and repair/renovation projects are highly variable, depending on the specific requirements of the particular project and on many other factors as well (e.g., geographic region of the country). Such differences, which are of crucial importance in project planning, are obscured in the kinds of multiproject averages that can be constructed from this study's data.

Deferred Capital Needs

The study asked institutions to report on *deferred* construction and repair/renovation costs that were *included in an approved institutional plan.* For definition purposes, the survey stated that *deferred* space must satisfy the following four criteria: the space must be necessary to meet the critical needs of current faculty or programs; construction must *not* be scheduled to begin in FYs 1994 or 1995; the construction must *not* currently have funding; and the space must *not* be for developing new programs or for expanding the number of faculty. Although such a question prevents respondents from being too speculative, the item fails to include needs that may, in fact, exist but not be part of an institutional plan. Given the fiscal realities of the 1990s, many universities and colleges may *need* new S&E facilities but competing priorities, coupled with decreased budgets, may result in institutions not incorporating such needs into official planning documents. Since 40 percent of all institutions indicated that they had an institutional plan that included deferred capital projects, the estimate of need derived from responses to this question must be interpreted as a conservative estimate of overall S&E facility needs.

Appendix B

List of Sampled Institutions

List of Sampled Institutions

Public, doctorate-granting institutions

Top 100	*Institution name*	*State*
*	University of Alaska Fairbanks	AK
*	Auburn University	AL
*	University of Alabama at Birmingham	AL
	University of South Alabama	AL
	University of Arkansas	AR
	University of Arkansas for Medical Sciences	AR
*	Arizona State University	AZ
*	University of Arizona	AZ
	San Diego State University	CA
*	University of California	CA
*	University of California-Davis	CA
*	University of California-Irvine	CA
*	University of California-Los Angeles	CA
*	University of California-Riverside	CA
*	University of California-San Diego	CA
*	University of California-San Francisco	CA
*	University of California-Santa Barbara	CA
	University of California-Santa Cruz	CA
	Colorado School of Mines	CO
*	Colorado State University	CO
*	University of Colorado at Boulder	CO
	University of Colorado at Colorado Springs	CO
*	University of Colorado Health Sciences Center	CO

Public, doctorate-granting institutions

Top 100	*Institution name*	*State*
*	University of Connecticut	CT
	University of Delaware	DE
	Florida Agricultural and Mechanical University	FL
	Florida State University	FL
*	University of Florida	FL
*	University of South Florida	FL
*	Georgia Institute of Technology	GA
	Georgia State University	GA
*	University of Georgia	GA
*	University of Hawaii at Manoa	HI
*	Iowa State University	IA
*	University of Iowa	IA
	Idaho State University	ID
	Southern Illinois University at Carbondale	IL
*	University of Illinois at Chicago	IL
*	University of Illinois at Urbana-Champaign	IL
	Ball State University	IN
*	Indiana University	IN
*	Purdue University	IN
	Kansas State University	KS
*	University of Kansas	KS
	Wichita State University	KS
*	University of Kentucky	KY
	Grambling State University	LA

Public, doctorate-granting institutions

Top 100	*Institution name*	*State*
*	Louisiana State University	LA
*	University of Massachusetts at Amherst	MA
	University of Massachusetts Lowell	MA
*	University of Maryland at Baltimore	MD
*	University of Maryland College Park	MD
*	Michigan State University	MI
	Michigan Technological University	MI
*	University of Michigan-Ann Arbor	MI
*	Wayne State University	MI
*	University of Minnesota	MN
*	University of Missouri-Columbia	MO
*	Mississippi State University	MS
	University of Mississippi	MS
	Montana State University	MT
	East Carolina University	NC
*	North Carolina State University	NC
*	University of North Carolina at Chapel Hill	NC
	North Dakota State University	ND
*	University of Nebraska-Lincoln	NE
	University of Nebraska Medical Center	NE
*	Rutgers, the State University of New Jersey	NJ
*	University of Medicine and Dentistry of New Jersey	NJ

Public, doctorate-granting institutions

Top 100	*Institution name*	*State*
	New Mexico Institute of Mining and Technology	NM
*	New Mexico State University	NM
*	University of New Mexico	NM
	University of Nevada-Reno	NV
*	State University of New York at Buffalo	NY
*	State University of New York at Stony Brook	NY
	State University of New York College of Environmental Sciences and Forestry	NY
	State University of New York Health Science Center at Brooklyn	NY
	Bowling Green State University	OH
	Cleveland State University	OH
	Ohio University	OH
*	The Ohio State University	OH
*	University of Cincinnati	OH
*	Oklahoma State University	OK
*	University of Oklahoma	OK
*	Oregon State University	OR
	University of Oregon	OR
*	Pennsylvania State University	PA
	Temple University	PA
*	University of Pittsburgh	PA
*	Clemson University	SC
	University of South Carolina	SC

Public, doctorate-granting institutions

Top 100	Institution name	State
	South Dakota State University	SD
	Memphis State University	TN
	Tennessee State University	TN
*	University of Tennessee, Knoxville	TN
	Lamar University	TX
	Stephen F. Austin State University	TX
*	Texas A & M University	TX
	Texas Tech University	TX
	Texas Woman's University	TX
	University of Houston	TX
	University of North Texas	TX
	University of Texas at Arlington	TX
*	University of Texas at Austin	TX
	University of Texas Health Science Center at Houston	TX
	University of Texas Medical Branch at Galveston	TX
*	University of Texas Southwestern Medical Center at Dallas	TX
*	University of Texas System Cancer Center	TX
*	University of Utah	UT
*	Utah State University	UT
	College of William and Mary	VA
	George Mason University	VA

Public, doctorate-granting institutions

Top 100	*Institution name*	*State*
*	University of Virginia	VA
*	Virginia Commonwealth University	VA
*	Virginia Polytechnic Institute and State University	VA
*	University of Washington	WA
*	Washington State University	WA
*	University of Wisconsin-Madison	WI
	University of Wisconsin-Milwaukee	WI
	West Virginia University	WV

Private, doctorate-granting institutions

Top 100	*Institution name*	*State*
*	California Institute of Technology	CA
*	Stanford University	CA
*	University of Southern California	CA
	University of Denver	CO
	Wesleyan University	CT
*	Yale University	CT
	American University	DC
	George Washington University	DC
*	Georgetown University	DC
	Howard University	DC
	Florida Institute of Technology	FL
*	University of Miami	FL
	Clark Atlanta University	GA
*	Emory University	GA
	Morehouse School of Medicine	GA
	Loyola University of Chicago	IL
*	Northwestern University	IL
	Rush University	IL
*	University of Chicago	IL
	University of Health Sciences/ The Chicago Medical School	IL
*	Tulane University	LA
	Xavier University of Louisiana	LA
	Boston College	MA

Private, doctorate-granting institutions

Top 100	Institution name	State
*	Boston University	MA
	Brandeis University	MA
*	Harvard University	MA
*	Massachusetts Institute of Technology	MA
	Smith College	MA
	Tufts University	MA
*	Woods Hole Oceanographic Institute	MA
	Worcester Polytechnic Institute	MA
*	Johns Hopkins University	MD
	Kirksville College of Osteopathic Medicine	MO
	St. Louis University	MO
*	Washington University	MO
*	Duke University	NC
	Wake Forest University	NC
	Dartmouth College	NH
*	Princeton University	NJ
	Seton Hall University	NJ
	Albany Medical College	NY
	Clarkson University	NY
*	Columbia University in the City of New York	NY
*	Cornell University	NY
*	Mount Sinai School of Medicine	NY
*	New York University	NY

Private, doctorate-granting institutions

Top 100	*Institution name*	*State*
	Rensselaer Polytechnic Institute	NY
*	Rockefeller University	NY
*	University of Rochester	NY
*	Yeshiva University	NY
*	Case Western Reserve University	OH
*	Carnegie Mellon University	PA
	Drexel University	PA
	Lehigh University	PA
	The Medical College of Pennsylvania	PA
	Thomas Jefferson University	PA
*	University of Pennsylvania	PA
	Brown University	RI
	Providence College	RI
	Meharry Medical College	TN
*	Vanderbilt University	TN
*	Baylor College of Medicine	TX
	Rice University	TX
	Marquette University	WI
	Medical College of Wisconsin	WI

Public, nondoctorate-granting institutions

Institution name	*State*
Alabama Agricultural and Mechanical University	AL
Alabama State University	AL
Trenholm State Technical College	AL
University of Arkansas at Pine Bluff	AR
California Polytechnic State University-Pomona	CA
California State University-Chico	CA
California State University-Fresno	CA
California State University-Fullerton	CA
California State University-Hayward	CA
California State University-Long Beach	CA
Humboldt State University	CA
San Jose State University	CA
University of the District of Columbia	DC
Delaware State College	DE
Albany State College	GA
Fort Valley State College	GA
Southern Illinois University at Edwardsville	IL
Western Illinois University	IL
Kentucky State University	KY
Morehead State University	KY
Murray State University	KY
Southern University and A&M College at Baton Rouge	LA
University of Massachusetts Dartmouth	MA
Coppin State College	MD

Public, nondoctorate-granting institutions

Institution name	*State*
Morgan State University	MD
Towson State University	MD
University of Maryland Eastern Shore	MD
Grand Valley State University	MI
Northern Michigan University	MI
Mankato State University	MN
Lincoln University	MO
Northeast Missouri State University	MO
Alcorn State University	MS
Delta State University	MS
Jackson State University	MS
Mississippi Valley State University	MS
North Carolina Agricultural and Technical State University	NC
North Carolina Central University	NC
University of North Carolina at Charlotte	NC
Winston-Salem State University	NC
Eastern New Mexico University	NM
University of Nevada-Las Vegas	NV
City University of New York College of Staten Island	NY
City University of New York Queens College	NY
City University of New York York College	NY
State University of New York College at Brockport	NY
State University of New York College at Buffalo	NY
State University of New York College at Geneseo	NY

Public, nondoctorate-granting institutions

Institution name	*State*
Central State University	OH
Langston University	OK
Western Oregon State College	OR
California University of Pennsylvania	PA
Clarion University of Pennsylvania	PA
East Stroudsburg University of Pennsylvania	PA
Edinboro University of Pennsylvania	PA
Lincoln University	PA
South Carolina State College	SC
Winthrop College	SC
Prairie View A & M University	TX
Texas A & I University	TX
Texas Southern University	TX
University of Houston-Clear Lake	TX
West Texas State University	TX
James Madison University	VA
Norfolk State University	VA
Virginia Military Institute	VA
Virginia State University	VA
University of the Virgin Islands	VI
Central Washington University	WA
Eastern Washington University	WA
University of Wisconsin-Green Bay	WI

Public, nondoctorate-granting institutions

Institution name	*State*
University of Wisconsin-Parkside	WI
University of Wisconsin-River Falls	WI
University of Wisconsin-Stout	WI
Marshall University	WV

Private, nondoctorate-granting institutions

Institution name	*State*
Oakwood College	AL
Selma University	AL
Tuskegee University	AL
Chapman University	CA
Harvey Mudd College	CA
Occidental College	CA
Pomona College	CA
Colorado College	CO
Connecticut College	CT
Quinnipiac College	CT
Rollins College	FL
Morehouse College	GA
Grinnell College	IA
Knox College	IL
DePauw University	IN
Valparaiso University	IN
Dillard University	LA
Loyola University	LA
Amherst College	MA
Emmanuel College	MA
Mount Holyoke College	MA
Regis College	MA
Wellesley College	MA
Wentworth Institute of Technology	MA

Private, nondoctorate-granting institutions

Institution name	*State*
Williams College	MA
Goucher College	MD
Bowdoin College	ME
Carleton College	MN
St. Mary's College	MN
Tougaloo College	MS
Johnson C. Smith University	NC
Monmouth College	NJ
Barnard College	NY
Ithaca College	NY
Manhattan College	NY
Vassar College	NY
Webb Institute of Naval Architecture	NY
College of Wooster	OH
Xavier University	OH
Reed College	OR
University of Portland	OR
Bucknell University	PA
Franklin and Marshall College	PA
Haverford College	PA
Swarthmore College	PA
Widener University	PA
Fisk University	TN
St. Mary's University San Antonio	TX

Private, nondoctorate-granting institutions

Institution name	*State*
Hampton University	VA
Middlebury College	VT
Pacific Lutheran University	WA
Beloit College	WI
Lawrence University	WI
Milwaukee School of Engineering	WI

Historically Black Colleges and Universities

Institution name	*State*
Trenholm State Technical College	AL
Alabama Agricultural and Mechanical University	AL
Alabama State University	AL
Oakwood College	AL
Selma University	AL
Tuskegee University	AL
University of Arkansas at Pine Bluff	AR
Howard University	DC
University of the District of Columbia	DC
Delaware State College	DE
Florida Agricultural and Mechanical University	FL
Morehouse College	GA
Albany State College	GA
Clark Atlanta University	GA
Fort Valley State College	GA
Morehouse School of Medicine	GA
Kentucky State University	KY
Southern University and A&M College at Baton Rouge	LA
Dillard University	LA
Grambling State University	LA
Xavier University of Louisiana	LA
University of Maryland Eastern Shore	MD
Coppin State College	MD
Morgan State University	MD

Historically Black Colleges and Universities

Institution name	*State*
Lincoln University	MO
Alcorn State University	MS
Jackson State University	MS
Mississippi Valley State University	MS
Tougaloo College	MS
North Carolina Agricultural & Technical State University	NC
Johnson C. Smith University	NC
North Carolina Central University	NC
Winston-Salem State University	NC
Central State University	OH
Langston University	OK
Lincoln University	PA
South Carolina State College	SC
Fisk University	TN
Meharry Medical College	TN
Tennessee State University	TN
Prairie View A & M University	TX
Texas Southern University	TX
Hampton University	VA
Virginia State University	VA
Norfolk State University	VA
University of the Virgin Islands	VI

Appendix C

Survey Questionnaire

NSF Form: 1264 (9/93)

OMB # 3145-0101
Expires 1/31/94

1994 SURVEY OF SCIENTIFIC AND ENGINEERING RESEARCH FACILITIES AT COLLEGES AND UNIVERSITIES

National Science Foundation
National Institutes of Health

Acting out of concerns raised by the academic community, Congress directed the National Science Foundation (NSF) to collect and analyze data about research facilities at colleges and universities and to report to Congress every two years. This survey is in response to that requirement under authorization of the National Science Foundation Act of 1950, as amended.

For this survey, we're asking you to respond to 12 items in these five categories:

- amount of space in your institution,
- amount and condition of research space in your institution,
- costs of renovation/repair and new construction of research space completed or begun,
- amount of new space needed for current research projects, and
- miscellaneous topics.

We will use the information that you provide us for a report that gives a broad, quantitative picture of

- the cost, availability, and condition of existing research facilities; and
- the current capital spending by colleges and universities, sources of funding, and plans for future construction and renovation of research facilities.

The report is used by Congress, many higher education associations, and university and college administrations to help make policy decisions. NSF and NIH do not use or allow other agencies to use the information from this survey to affect individual institutional funding, nor will detailed responses be used in any manner that would identify an individual institution's responses. Your participation in this survey is voluntary.

The president or chancellor of your institution named the individual on the label below to coordinate data collection for this survey. Please correct any wrong information on the label.

Label

If someone other than the person listed above coordinates the data collection, please tell us whom we may call if we have questions about the information.

Name	**Title/Department**	**Telephone no. and ext.**

Completing this survey requires an average of 30 hours. If you wish to comment on this burden, contact Herman Fleming, Reports Clearance Officer, NSF, at 703–306–1243, and the Office of Management and Budget, Paperwork Reduction Project (OMB Number 3145–0101), Washington, DC 20503.

Return the completed survey by *December 1, 1993*, to *The Gallup Organization*
Attention: Sean Stevens
300 South 68th St. Place
Lincoln, NE 68510

If you have any questions or comments about the survey, contact Dr. Ann Lanier of NSF at 703–306–1774 or Jennifer Spielvogel of The Gallup Organization at 1–800–288–9439.

Definitions and Guidelines

Use the definitions and guidelines in this section as you fill out the survey.

DEFINITIONS

Research

Refers to all research and development activities of an institution that are budgeted and accounted for. Research can be funded by the federal government, state governments, foundations, corporations, universities, or other sources.

Research Facilities

Refers to the physical plant in which research activities take place, including

- research laboratories;
- controlled-environment space, such as clean or white rooms;
- technical-support space, such as carpentry and machine shops;
- facilities for laboratory animals, such as animal production colonies, holding rooms, isolation and germ-free rooms;
- faculty or staff offices, to the extent that they are used for research;
- department libraries, to the extent that they are used for research; and
- fixed (built-in) equipment such as fume hoods and benches.

Does not include

- non-fixed equipment costing less than $1 million (these data are collected in a separate NSF/NIH survey);
- facilities that have been designated as federally funded research and development centers, such as Brookhaven National Lab, Kitt Peak, Fermi Lab, etc.; or
- facilities that are used by faculty but are not administered by the institution, such as research space at Veterans Administration or other non-university hospitals.

Research Space

Refers to the net assignable square feet (NASF) of space in facilities within which research activities take place.

Repair/Renovation

Refers to the fixing up of facilities in deteriorated condition, capital improvements on facilities, conversion of facilities, and so on.

New Construction

Refers to additions to an existing building or construction of a new building.

Science and Engineering (S&E) Fields

Because every institution has its own way of classifying fields of study, for consistency please use the cross reference (see page 16) to classify areas of study at your institution. The cross reference identifies the departments that are included within each of the science and engineering (S&E) fields used in this survey. The cross reference is based on the classification of instructional programs used by the National Center for Educational Statistics.

If you are unable to separate data for academic programs, report the combined data under "Other Sciences, not elsewhere classified" and list the fields that those data represent.

For this survey, Science and Engineering (S&E) Fields include

- Engineering
- Physical Sciences
- Environmental Sciences
- Mathematics
- Computer Sciences
- Agricultural Sciences
- Biological Sciences
- Medical Sciences
- Psychology
- Social Sciences
- Other Sciences, not elsewhere classified

They do not include

- law, business administration/management (except economics), humanities, history, the arts, or education (except educational psychology), for example.

GUIDELINES

For multi-purpose space

Prorate the net assignable square feet (NASF) to reflect the proportion of use devoted to research activity.

For example, if a room or building is devoted to research activity approximately 40% of the time, count 40% of the NASF as research space.

For shared space

Prorate the NASF to reflect the proportion of use devoted to each field.

For example, if a room or building is devoted equally to research activity in Computer Sciences and Mathematics, count 50% of the NASF as research space for Computer Sciences and 50% for Mathematics.

For multi-purpose facilities

Prorate the cost of repair/renovation and new construction projects to reflect the proportion of research space involved.

For multi-year projects

Allocate the entire project completion cost (planning, construction, fixed equipment) to the fiscal year in which construction actually began or is expected to begin.

Amount of Space in Your Facility

Item 1a. Instructional and research space

To determine the current amount of instructional and research space in your facilities, include

- all space assigned to the fields or to the departments within fields, such as departmental and faculty offices, conference and seminar rooms, research space, and instructional space; and
- space leased by your institution.

If the information is not available, you may estimate the amounts.

❶ In **Column 1** on the next page, fill in the current amount of net assignable square feet (NASF) devoted to *instruction and research* for each field or department listed.

❷ Then near the bottom of **Column 1**, fill in the current *total* NASF devoted to instruction and research for

- science and engineering (S&E) fields,
- non-science fields, and
- all S&E and all non-science fields.

❸ In **Column 2**, fill in the current amount of NASF devoted to *research only* for each S&E field or department listed.

❹ Then at the bottom of **Column 2**, fill in the *total* NASF devoted to research in all S&E fields.

Note for institutions using a facilities inventory system based on either NCES, NACUBO, or WICHE classifications:

For **Column 1**, Instructional and Research NASF, *add* the space that is assigned to functional category 1 (Instruction) and to functional category 2 (Research). For **Column 2**, Research NASF, use *only* the space that is assigned to functional category 2 (Research).

Please refer to pages 95–96 in Appendix 2 of *Postsecondary Education Facilities Inventory and Classification Manual*, U.S. Department of Education, Office of Educational Research and Improvement, NCES 92–165. The definitions in that book are adapted from the 1988 NACUBO *Taxonomy of Functions* and the 1972 WICHE *Program Classification Structure.*

Field	Column 1 Instructional and Research NASF	Column 2 Research NASF
SCIENCE AND ENGINEERING (S&E) FIELDS		
Engineering		
Physical Sciences		
Environmental Sciences		
Mathematics		
Computer Sciences		
Agricultural Sciences		
Biological Sciences Other than medical school		
Biological Sciences Medical school		
Medical Sciences Other than medical school		
Medical Sciences Medical school		
Psychology		
Social Sciences		
Other Sciences, not elsewhere classified List them:		
TOTAL FOR ALL S&E FIELDS		
TOTAL FOR ALL NON-SCIENCE FIELDS [for example, law, business administration/management (except economics), humanities, history, the arts, and education (except educational psychology)]		
TOTAL FOR ALL S&E AND ALL NON-SCIENCE FIELDS		

Item 1b. Leased research and development space

Look at the total research space for all S&E facilities at the bottom of **Column 2** in the chart above. How much of that space is leased?

_____ **NASF of leased research space**

Amount of Research Space

Item 2. Amount of research space, by field

To rate whether the amount of research space at your institution reported in **Item 1a, Column 2** is sufficient for current research programs, consider

- only the existing amount of research space, and
- only your current research programs.

For each field listed below, circle one of the following codes:

A Adequate amount; sufficient to support all the needs of your research in the field

B Generally adequate amount; sufficient to support most of your research needs in the field but may have some limitations

C Inadequate amount; not sufficient to support the needs of your research in the field

D Nonexistent space but needed

NA Not applicable or not needed

Field	Amount of research space (circle one in each row)				
Engineering	A	B	C	D	NA
Physical Sciences	A	B	C	D	NA
Environmental Sciences	A	B	C	D	NA
Mathematics	A	B	C	D	NA
Computer Sciences	A	B	C	D	NA
Agricultural Sciences	A	B	C	D	NA
Biological Sciences Other than medical school	A	B	C	D	NA
Biological Sciences Medical school	A	B	C	D	NA
Medical Sciences Other than medical school	A	B	C	D	NA
Medical Sciences Medical school	A	B	C	D	NA
Psychology	A	B	C	D	NA
Social Sciences	A	B	C	D	NA
Other Sciences, not elsewhere classified List them:	A	B	C	D	NA

Who provided the above assessments (e.g., deans, department heads, physical plant administrators, the survey coordinator)? _____

_____

Item 3. Current condition of research space, by field

To rate the condition of current research space reported in **Item 1a, Column 2,**

- consider only current research programs,
- consider the type of research conducted in the facility, and
- exclude non-fixed research instrumentation costing less than $1 million.

For each field, fill in the percentage of research space that falls into each category below.

A Suitable for use in the most highly developed and scientifically sophisticated research in the field
B Effective for most purposes but not applicable to category **A**
C Effective for some purposes but in need of limited renovation or repair
D Requires major repair or renovation to be used effectively
E Requires replacement
NA Not applicable or no research space in this field

Field	Percentage of research space according to condition						
	A	B	C	D	E	NA	Total
Engineering							100%
Physical Sciences							100%
Environmental Sciences							100%
Mathematics							100%
Computer Sciences							100%
Agricultural Sciences							100%
Biological Sciences Other than medical school							100%
Biological Sciences Medical school							100%
Medical Sciences Other than medical school							100%
Medical Sciences Medical school							100%
Psychology							100%
Social Sciences							100%
Other Sciences, not elsewhere classified List them:							100%

Who provided the above assessments (e.g., deans, department heads, physical plant administrators, the survey coordinator)? _____

_____

Costs of Projects Completed or

Item 4a. Research facilities projects over $100,000: your FY 1992 and FY 1993

To report the *completion costs* (planning, construction, fixed equipment) and net assignable square feet (NASF) involved in repair/renovation and new construction of research facilities,

- consider only projects begun during your Fiscal Year 1992 or your Fiscal Year 1993,
- consider only projects over $100,000 (see **Item 7** for projects under $100,000), and
- prorate as necessary.

❶ In **Columns 1** and **3**, fill in the *completion costs* for repair/renovation and for new construction for each field listed.

❷ Then fill in the total *completion costs* for all science and engineering (S&E) fields at the bottom of **Columns 1** and **3**.

❸ In **Columns 2** and **4**, estimate the NASF involved in these projects for each field listed.

❹ Then estimate the total NASF involved for all S&E fields at the bottom of **Columns 2** and **4**.

Field	REPAIR/RENOVATION begun during your FY 1992 or 1993		NEW CONSTRUCTION begun during your FY 1992 or 1993	
	Column 1	Column 2	Column 3	Column 4
	Cost	NASF	Cost	NASF
Engineering				
Physical Sciences				
Environmental Sciences				
Mathematics				
Computer Sciences				
Agricultural Sciences				
Biological Sciences Other than medical school				
Biological Sciences Medical school				
Medical Sciences Other than medical school				
Medical Sciences Medical school				
Psychology				
Social Sciences				
Other Sciences, not elsewhere classified List them:				
TOTAL FOR ALL S&E FIELDS				

Item 4b. Costs to comply with the 1990 Americans with Disabilities Act

Look at the total cost reported in **Item 4a** in the last row of **Column 1**. Estimate the percentage of these total repair and renovation costs that your institution spent to bring this space into compliance with the 1990 Americans with Disabilities Act.

_____ **% spent to comply with the 1990 Americans with Disabilities Act**

Item 5. Sources of funding for research facilities projects over $100,000: your FY 1992 and FY 1993

To provide the sources of funding for the projects begun during your Fiscal Year 1992 or your Fiscal Year 1993, which you reported in **Item 4a,**

❶ Look back at the last row of the chart in **Item 4a.** Copy the totals that you wrote in **Columns 1** and **3** into the first row below.

❷ Fill in the expected dollar amounts of funding that you anticipate from each source listed below.

Source	Column 1 REPAIR/RENOVATION begun during your FY 1992 or 1993	Column 2 NEW CONSTRUCTION begun during your FY 1992 or 1993
COST OF ALL PROJECTS FOR S&E RESEARCH FACILITIES		
Federal Government		
State or Local Government		
Private Donation		
Institutional Funds Operating funds, endowments, indirect cost recovery, etc.		
Tax-Exempt Bonds		
Other Debt Financing		
Other Sources of Funding List them:		

Item 6. Actual vs. planned research facilities spending: your FY 1992 and FY 1993

❶ Did your institution fill out this survey in 1992?

- ❑ Yes. Go to ❷.
- ❑ No. Go to **Item 7** on the next page.

❷ On the copy of your responses to the 1992 survey (included in this survey package), look at the total amount your institution planned to spend for repair/renovation of research facilities during your Fiscal Year 1992 and your Fiscal Year 1993. You'll find this amount listed under Item 5 in the 1992 survey.

Now, look at the amount you wrote in the first row of **Column 1** in **Item 5** on the previous page. Is that amount within 25% (±) of the amount of spending listed under Item 5 in your 1992 survey?

- ❑ Yes. Go to ❸.
- ❑ No. What factors account for the difference?

_____

_____

_____

_____

❸ On the copy of your responses to the 1992 survey, look at the total amount your institution planned to spend for new construction of research facilities during your Fiscal Year 1992 and your Fiscal Year 1993. You'll also find this amount under Item 5 in the 1992 survey.

Now, look at the amount you wrote in the first row of **Column 2** in **Item 5** on the previous page. Is that amount within 25% (±) of the amount of spending listed under Item 5 in your 1992 survey?

- ❑ Yes. Go to **Item 7** on the next page.
- ❑ No. What factors account for the difference?

_____

_____

_____

_____

Item 7. Repair/renovation projects between $5,000 and $100,000: your FY 1992 and FY 1993

To report the *completion costs* (planning, construction, fixed equipment) involved in repair/renovation of science and engineering (S&E) research facilities,

- include only costs for research components,
- consider only projects begun during your Fiscal Year 1992 or your Fiscal Year 1993, and
- consider only projects costing between $5,000 and $100,000 (see **Item 4a** for projects over $100,000).

Fill in the total dollar amount in the space below, prorating as necessary.

$ _____ **Total for all S&E research facilities**

Item 8. Planned research facilities over $100,000 scheduled to begin construction in your FY 1994 and FY 1995

To report the *completion costs* (planning, construction, fixed equipment) and net assignable square feet (NASF) for repair/renovation and new construction of research facilities that your institution plans to begin,

- consider only projects in which construction is planned to begin during your Fiscal Year 1994 or your Fiscal Year 1995,
- consider only projects expected to cost over $100,000, and
- prorate as necessary.

❶ In **Columns 1** and **3**, fill in the *completion costs* for repair/renovation and for new construction for each field listed.

❷ Then fill in the total *completion costs* for all science and engineering (S&E) fields at the bottom of **Columns 1** and **3**.

❸ In **Columns 2** and **4**, estimate the NASF involved in these projects for each field listed.

❹ Then fill in the total NASF for all S&E fields at the bottom of **Columns 2** and **4**.

Field	REPAIR/RENOVATION scheduled to begin in your FY 1994 or 1995		NEW CONSTRUCTION scheduled to begin in your FY 1994 or 1995	
	Column 1	Column 2	Column 3	Column 4
	Expected Cost	Estimated NASF	Expected Cost	Estimated NASF
Engineering				
Physical Sciences				
Environmental Sciences				
Mathematics				
Computer Sciences				
Agricultural Sciences				
Biological Sciences Other than medical school				
Biological Sciences Medical school				
Medical Sciences Other than medical school				
Medical Sciences Medical school				
Psychology				
Social Sciences				
Other Sciences, not elsewhere classified List them:				
TOTAL FOR ALL S&E FIELDS				

Space Needed

Item 9. Research space needed for current faculty and programs but *not* scheduled to begin construction during your FY 1994 or FY 1995

❶ Does your *approved institutional plan* include any *deferred* space that requires repair/renovation or new construction? (*Deferred* space must satisfy the following four criteria: the space must be necessary to meet the critical needs of your current faculty or programs; construction must *not* be scheduled to begin during your Fiscal Year 1994 or your Fiscal Year 1995; the construction must *not* currently have funding; and the space must *not* be for developing new programs or for expanding the number of faculty.)

- ☐ Yes. How many years does your plan include?_____ Go to ❷.
- ☐ No. Go to **Item 10** on the next page.

❷ For each field listed, estimate and record in **Column 1** the *completion costs* (planning, construction, fixed equipment) for *deferred* space which needs *repair/renovation.*

❸ Then add up the estimates and record the total at the bottom of **Column 1**.

❹ For each field listed, estimate and record in **Column 2** the *completion costs* for *deferred* space which needs *new construction.*

❺ Then add up the estimates and record the total at the bottom of **Column 2**.

❻ If you cannot provide cost estimates, then check here ☐ and fill in *estimated NASF* in the chart below.

Field	Column 1 Estimated costs for needed REPAIR/ RENOVATION *not* scheduled to begin during your FY 1994 or 1995	Column 2 Estimated costs for needed NEW CONSTRUCTION *not* scheduled to begin during your FY 1994 or 1995
Engineering		
Physical Sciences		
Environmental Sciences		
Mathematics		
Computer Sciences		
Agricultural Sciences		
Biological Sciences Other than medical school		
Biological Sciences Medical school		
Medical Sciences Other than medical school		
Medical Sciences Medical school		
Psychology		
Social Sciences		
Other Sciences, not elsewhere classified List them:		
TOTAL FOR ALL S&E FIELDS		

Miscellaneous Topics

Item 10. Facilities for laboratory animals

❶ Does your institution have facilities for laboratory animals?

- ☐ No. Go to **Item 11** on the next page.
- ☐ Yes. Go to ❷.

❷ To report on facilities for laboratory animals,

Include

- both departmental and central facilities that are subject to government (U.S. Public Heath Service, USDA, state) regulations concerning humane care and use of laboratory animals; and
- all animal housing areas (e.g., cage rooms, stalls, wards, animal production colonies, laboratory space occupied by animals), holding rooms, isolation and germ-free rooms, surgical facilities, and other related service areas (e.g., feed storage rooms, cage-washing rooms, casting rooms, shops, storage), if these areas directly support research.

Do not include

- agricultural field buildings sheltering animals that do not directly support research or that are not subject to government regulations concerning humane care and use of laboratory animals, or
- areas for treatment of animals that are veterinary patients.

Fill in the total amount of net assignable square feet (NASF) allotted to these facilities. Then fill in the amount of NASF allotted to research facilities for laboratory animals.

_____ **Total NASF**

_____ **Research NASF**

❸ Fill in the percentage of research NASF that

fully meets government regulations	_____ %
needs limited renovation or repair to meet government regulations	_____ %
needs major renovation, repair, or replacement to meet government regulations	_____ %
	100 %

❹ Fill in the cost of repair/renovation and construction projects planned to begin during your Fiscal Year 1994 or your Fiscal Year 1995. $ _____

Item 11. Limit on tax-exempt bonds

❶ Is your institution a private college or university?

- ❑ No. Go to **Item 12.**
- ❑ Yes. Go to ❷.

❷ Recent federal tax reform legislation established a limit on tax-exempt bonds of $150 millon per private college or university.

Has your institution reached the limit on tax-exempt bonds?

- ❑ Yes.
- ❑ No, but we expect to within the next two fiscal years.
- ❑ No, and we do not expect to within the next two fiscal years.

Item 12. Feedback

We appreciate the time you have taken to fill out the 1994 survey. We will be extensively revising the 1996 survey to help make your task less burdensome and to improve the reliability of the information.

❶ Would you be willing to discuss drafts of the revised survey with members of the development team?

- ❑ Yes. Please write your name and phone number below.

_____

_____

_____

_____

- ❑ No.

❷ How many person-hours were required to complete this form? _____

You are finished with the survey. *Return it by December 1, 1993,* to *The Gallup Organization*
Attention: Sean Stevens
300 South 68th St. Place
Lincoln, NE 68510

CROSS REFERENCE BETWEEN NSF FIELD CATEGORIES AND THE NCES CLASSIFICATION OF INSTRUCTIONAL PROGRAMS

Use this chart to identify the departments that are included within each of the science and engineering (S&E) fields used in this survey.

ENGINEERING

101 Aerospace Engineering
- 14.02 Aerospace, aeronautical, and astronautical engineering

102 Agricultural Engineering
- 14.03 Agricultural engineering

103 Biomedical Engineering
- 14.05 Bioengineering and biomedical engineering

104 Chemical Engineering
- 03.0509 Wood sciences
- 14.07 Chemical engineering

105 Civil Engineering
- 04.02 Architecture
- 14.04 Architectural engineering
- 14.08 Civil engineering
- 14.14 Environmental health engineering

106 Electrical Engineering
- 14.09 Computer engineering
- 14.10 Electrical, electronics, and communications engineering
- 14.1002 Microelectronic engineering

107 Engineering Science
- 14.12 Engineering physics
- 14.13 Engineering science

108 Industrial Engineering/Management Science
- 14.17 Industrial engineering
- 14.27 Systems engineering
- 30.06 Systems science

109 Mechanical Engineering
- 14.11 Engineering mechanics
- 14.19 Mechanical engineering

110 Metallurgical and Materials Engineering
- 14.06 Ceramic engineering
- 14.18 Materials engineering
- 14.20 Metallurgical engineering
- 40.0701 Metallurgy

111 Mining Engineering
- 14.15 Geological engineering
- 14.16 Geophysical engineering
- 14.21 Mining and mineral engineering

112 Nuclear Engineering
- 14.23 Nuclear engineering

113 Petroleum Engineering
- 14.25 Petroleum engineering

114 Engineering, not elsewhere classified
- 14.01 Engineering, general
- 14.22 Naval architecture and marine engineering
- 14.24 Ocean engineering
- 14.28 Textile engineering
- 14.99 Engineering, other
- 19.09 Textiles and clothing (excluding 19.0902, Fashion Design)
- 30.03 Engineering and other fields

PHYSICAL SCIENCES

201 Astronomy
- 40.02 Astronomy
- 40.03 Astrophysics
- 40.09 Planetary science

202 Chemistry
- 40.05 Chemistry

203 Physics
- 40.08 Physics

204 Physical Sciences, not elsewhere classified
- 40.01 Physical sciences, general
- 40.0799 Miscellaneous physical sciences, other
- 40.099 Physical sciences, other

ENVIRONMENTAL SCIENCES

301 Atmospheric Sciences
- 40.4 Atmospheric sciences and meteorology

302 Geosciences
- 14.26 Surveying and mapping sciences
- 40.06 Geological sciences
- 40.0703 Earth sciences

303 Oceanography
- 26.0607 Marine biology
- 40.0702 Oceanography

304 Environmental Sciences, not elsewhere classified

MATHEMATICS

402 Mathematics and Applied Mathematics
- 06.1302 Operations research (quantitative methods)
- 27.01 Mathematics, general
- 27.03 Applied mathematics
- 27.04 Pure mathematics
- 27.99 Mathematics, other
- 30.08 Mathematics and computer science

403 Statistics
- 27.02 Actuarial sciences
- 27.05 Statistics

COMPUTER SCIENCES

401 Computer Sciences
- 06.12 Management information systems
- 11 Computer and information sciences, general
- 30.09 Imaging science

AGRICULTURAL SCIENCES (SEE ALSO 102 AND 901)

501 Agricultural Sciences
- 02.01 Agricultural sciences, general
- 02.02 Animal sciences
- 02.03 Food sciences
- 02.04 Plant sciences
- 02.05 Soil sciences
- 02.99 Agricultural sciences, other
- 03.01 Renewable natural resources, general

03.03 Fishing and fisheries
03.05 Forestry and related sciences
03.06 Wildlife management
03.99 Renewable natural resources, other
31.04 Water resources

BIOLOGICAL SCIENCES

601 Anatomy
18.0201 Clinical anatomy
26.0601 Anatomy

602 Biochemistry
18.0202 Clinical biochemistry
26.02 Biochemistry and biophysics

603 Biology
26.01 Biology, general
26.0604 Embryology

604 Biometry and epidemiology
18.2202 Epidemiology
26.0602 Biometrics and biostatistics

605 Biophysics

606 Botany
26.03 Botany (excluding 26.0302, Bacteriology, see 611)

607 Cell Biology
26.04 Cell and molecular biology
26.0606 Histology

608 Ecology
26.0603 Ecology

609 Entomology and Parasitology
26.0610 Parasitology
26.07102 Entomology

610 Genetics
26.0703 Genetics, human and animal

611 Microbiology, Immunology, and Virology
18.0203 Clinical microbiology
18.1002 Allergies and endomology
18.1009 Immunology
26.0302 Bacteriology
26.05 Microbiology

612 Nutrition
19.05 Food sciences and human nutrition
20.0108 Food and nutrition
26.0609 Nutritional sciences

613 Pathology
18.0204 Clinical pathology
18.1018 Pathology
26.0704 Pathology, human and animal

614 Pharmacology
18.0206 Clinical toxicology
26.0612 Toxicology
26.0705 Pharmacology, human and animal
42.14 Psychopharmacology

615 Physiology
18.0205 Physiology
26.0706 Physiology, human and animal

616 Zoology
26.0701 Zoology
26.0799 Zoology, other

617 Biosciences, not elsewhere classified
26.0699 Miscellaneous specialized areas, life sciences, other
26.99 Life sciences, other

MEDICAL SCIENCES (see also 103)

701 Anesthesiology
18.1003 Anesthesiology

702 Cardiology

703 Cancer Research/Oncology

704 Endocrinology
26.0605 Endocrinology

705 Gastroenterology

706 Hematology
18.08 Hematology

707 Neurology
18.1024 Neurology
26.0608 Neurosciences

708 Obstetrics and Gynecology
18.1013 Obstetrics and gynecology

709 Ophthalmology
18.1014 Ophthalmology
18.12 Optometry

710 Otorhinolaryngology
18.1017 Otorhinolaryngology/otolaryngology

711 Pediatrics
18.1019 Pediatrics
20.0102 Child development

712 Preventive Medicine and Community Health
18.1007 Family practice
18.1022 Preventive medicine

713 Psychiatry
18.1023 Psychiatry
18.1106 Psychiatry/mental health

714 Pulmonary Disease

715 Radiology
18.1012 Nuclear medicine
18.1025 Radiology
26.0611 Radiobiology

716 Surgery
18.1004 Colon and rectal surgery
18.1011 Neurological surgery
18.1016 Orthopedic
18.1021 Plastic surgery
18.1026 Surgery
18.1027 Thoracic surgery

717 Clinical Medicine, not elsewhere classified
18.0299 Basic clinical health sciences, other
18.1001 Medicine, general
18.1005 Dermatology
18.1008 Geriatrics
18.1010 Internal medicine
18.1020 Physical medicine and rehabilitation
18.1028 Urology
18.1099 Medicine, other
18.13 Osteopathic medicine
18.15 Podiatry
30.01 Biological and physical sciences

718 Dental Sciences
18.04 Dentistry
18.1015 Orthodontic surgery

719 Nursing
18.11 Nursing (excluding 18.1106, Psychiatry/Mental Health, see 713)

720 Pharmaceutical Sciences
- 18.14 Pharmacy

721 Veterinary Sciences
- 18.24 Veterinary medicine

722 Health Related, not elsewhere classified
- 17.0807 Occupational therapy
- 17.0813 Physical therapy
- 17.0899 Rehabilitation services, other
- 17.99 Allied health, other
- 18.07 Health sciences administration
- 18.09 Medical laboratory
- 18.22 Public health
- 18.99 Health sciences, other

723 Speech Pathology and Audiology
- 18.01 Audiology and speech pathology

PSYCHOLOGY

801 Psychology
- 13.08 School psychology (not including Educational Psychology)
- 17.0801 Art therapy
- 42 Psychology (including Educational Psychology)

SOCIAL SCIENCES

901 Agricultural Economics
- 01.0102 Agricultural business and management
- 01.0103 Agricultural economics

902 Anthropology (Cultural and Social)
- 45.02 Anthropology
- 45.03 Archeology

903 Economics (except Agricultural)
- 06.05 Business Economics
- 45.06 Economics

904 Geography
- 45.07 Geography

905 History and philosophy of science

906 Linguistics
- 23.06 Linguistics
- 42.12 Psycholinguistics

907 Political Science
- 44.01 Public affairs, general
- 44.03 International public service
- 44.04 Public administration
- 44.05 Public policy studies
- 44.99 Public affairs, other
- 45.09 International affairs
- 45.10 Political science and government

908 Sociology
- 45.05 Demography
- 45.11 Sociology

909 Sociology and Anthropology

910 Social Sciences, not elsewhere classified
- 04.03 City, community, and regional planning
- 05 Area and ethnic studies
- 06.06 Human resources development
- 06.15 Organizational behavior
- 31.03 Parks and recreational management
- 43.01 Criminal justice
- 44.02 Community services
- 44.07 Social work
- 45.01 Social sciences, general
- 45.04 Criminology
- 45.12 Urban studies
- 45.99 Social sciences, other

Appendix D

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42 U.S. Code Sec. 289d. 1994 and CFR part 2 1994.

42 U.S.C. 1886.

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